PAGE'S WEEKLY.—March 3, 1905.
Thin Paper Copy for Circulation Abroad.

No. 25. Vol. 6.
SIXPENCE.
(Registered as a Newspaper.)
FRIDAY,
MARCH 3, 1905.

PAGE'S WEEKLY

LIBRARY
MAR 18 1905
UNIVERSITY OF TORONTO.

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

France, Paris: 28, Rue de la Banque.
Germany, Berlin: 13, Unter den Linden.
Russia, St. Petersburg: 14, Nevsky Prospect.
Italy, Rome: 307 Corso.
Austria, Vienna: Kärntnerstrasse, nr. 30.

India, Calcutta: Thacker, Spink & Co.
,, Bombay: Thacker & Co., Ltd.
South Africa, Cape Town: Gordon & Gotch.
Japan, Yokohama: Kelly & Walsh, Ltd.
New Zealand: Gordon & Gotch, Ltd.

Canada: Montreal News Company.
United States, New York: International News Co.
,, Chicago: Subscription News Co.
Australia, Melbourne: Gordon & Gotch.
Straits Settlements, Singapore: Kelly & Walsh, Ltd.

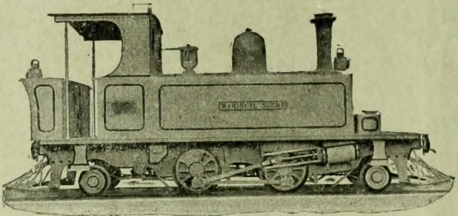
ESTABLISHED 1860. TEL. ADDRESS: "LOCO., LEEDS."

HUDSWELL, CLARKE & Co., LTD.,

RAILWAY FOUNDRY, LEEDS.

LOCOMOTIVE ENGINES,

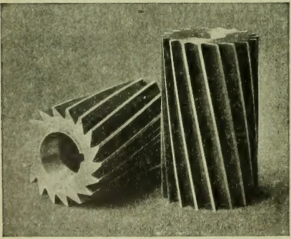
Of all sizes and any gauge of Railway, of greatly improved Construction, for Main or Branch Railways, Contractors, Ironworks, Collieries. Prices, Photographs, and full Specifications on application.



SOLE MAKERS OF THE "RODGERS" PULLEYS (Registered).

Wrought Iron throughout, Rim, Arms, and Boss.

ALSO "ETCHELLS'" NON-DRIP BEARINGS, SHAFTING, AND ACCESSORIES.



MILLING CUTTERS,

High Speed
or
Ordinary Steel.

E. G. WRIGLEY & CO., Ltd.,

Foundry Lane Works,
SOHO, BIRMINGHAM.

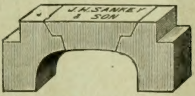
Sankey's Fire Bricks and Fire Cements.

Every Description of FIRE-CLAY GOODS. STOCK UNEQUALLED.

VARIOUS BRANDS

Engineers' Designs made to Order of the best Fire-resisting Materials.

WRITE FOR NEW CATALOGUE.

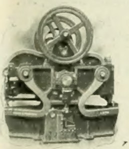


J. H. SANKEY & SON, Ltd., Head Office, Essex Wharf, CANNING TOWN, E.
ESTABLISHED 1857.

PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,
Consulting and Organising Engineer for Water Works and Industrial Undertakings,
97, QUEEN VICTORIA ST., LONDON, E.C.
Telephone No.: 5754 Bank. Write for particulars.

ED. BRAND, MECHANICAL ENGINEER, 35, SHAKESPEARE STREET, MANCHESTER.
Modern Wire-Working Machinery,
Such as for Rolling, Drawing, Weaving, Netting, Forming, Automatic Straightening and Cutting, Cabling, Testing, &c.
Inquiries Solicited. Teleg. Address: "Filieres, Manchester."



PUNCHING & SHEARING Machines.
STEAM HAMMERS.
Shipbuilders' MACHINE TOOLS.
DAVIS & PRIMROSE,
Leith Ironworks, EDINBURGH.

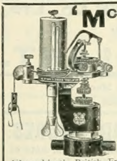
"UNICA" SILENT GEARS
Equal in STRENGTH to, and MORE DURABLE than, Cast Iron, Gun Metal, or Rawhide.
NO SIDE PLATES OR BUSHES! UNAFFECTED BY OIL!
Have stood test of four years.
J. B. HAMILTON & CO.,
Telegrams: "Verdampfer, London." 145, Cannon St., LONDON.

Bogie Locomotives for Short Curves. A large number of these Engines have been built to NARROW and to NORMAL GAUGE.—For full particulars, and for Licences, &c., address the HAGAN'S LOCOMOTIVE WORKS, ERFURT, GERMANY.

Melville and Macalpine, Consulting Engineers and NAVAL ARCHITECTS,
615, WALNUT STREET, PHILADELPHIA, PA., U.S.A.
Rear-Admiral GEORGE W. MELVILLE, Ex-Engineer-in-Chief of the United States Navy, and JOHN H. MACALPINE, having a very extensive acquaintance in the best engineering circles in the United States, Britain, and the Continent of Europe, especially SOLICIT INTERNATIONAL BUSINESS.

GRAHAM, MORTON & Co. LTD.
Head Office and Works, LEEDS.
Makers and Erectors of all Classes of
CONVEYING PLANTS, COAL HANDLING PLANTS, AERIAL ROPEWAYS, &c., &c.

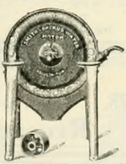
PAGE & ROWLINGSON,
Chartered Patent Agents.
MR. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*
28, NEW BRIDGE STREET, LONDON, E.C.,
And 14, St. Ann's Square, Manchester.



'McINNES-DOBBIE' INDICATORS.
In Two types: External and Enclosed Pressure Springs.
Each made in several forms and sizes to suit all speeds and pressures.
Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.
DOBBIE McINNES, LIMITED,
Adopted by the British, French and Japanese Admiralties. 45, BOTHWELL ST., GLASGOW.

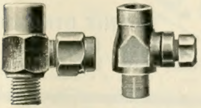
WAYGOOD LIFTS
APPLY FOR CATALOGUE.
FALMOUTH ROAD, LONDON, S.E.

BABCOCK & WILCOX, Ltd.
PATENT WATER-TUBE BOILERS.
These Boilers are in use throughout the world to the extent of 4,700,000 h.p., generating steam for all purposes, and fired with all kinds of fuel.
See our Advertisement appearing March 17th, page 45.
HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.
WORKS—Renfrew, SCOTLAND.

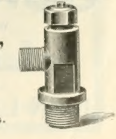


CHEAP POWER.
SMITH'S
Backus Water Motors
1/16 to 10 H.P.
Will drive any class of Machinery, and work on 15 lb. pressure.
ERIC S. A. SMITH, ENGINEER,
APPLY FOR CATALOGUE. BRIDLINGTON.

TRANSPORTERS.
See our Advertisement appearing March 17th.
TEMPERLEY TRANSPORTER CO.,
72, Bishopsgate Street Within, LONDON, E.C.
Telephone: 365 London Wall. Telegrams: "Transumo."



The
Scotch & Irish Oxygen Co., Ltd.,
ROSEHILL WORKS, GLASGOW.
Valves for Gas Bottles, Refrigerating Plant, etc., in Bronze, Steel, and Aluminium.
Reducing Valves, Keys, and all Fittings for Compressed Gases.



PAGE'S WEEKLY Miscellaneous

"ZECO" Brand.
Blue Planished and Glazed Steel Sheets for Lagging
and Covering generally.
ZEITZ & Co., 21, Lime St., London, E.C.

BRETT'S PATENT LIFTER Co., LTD.,
COVENTRY, ENG.
Speciality—
FORGING PLANT.
See our Advertisement appearing March 17th.
SEND FOR LATEST CATALOGUE.

MOULDERS' LETTERS AND FIGURES.
Marks, Name Stamps, Branding Irons, Sets of Letter and Figure Punches, Brass Labels and Time Checks, Embossing Presses, Dies and Seals, Brass Name Plates, Stencil Plates, India Rubber Stamps.
EDWARD PRYOR & SON,
68, West Street, SHEFFIELD.

THE PHOTOGRAPHING OF MACHINERY, &c.,
IS EXTENSIVELY UNDERTAKEN BY
MESSRS. ELLIOTT & FRY
in any part of the United Kingdom for which work special terms will be sent on application, distance being no object.
ONLY ADDRESS:—
55, Baker Street, LONDON, W.
Telegrams: PHOTICS, LONDON.
Telephone: 293 PADDINGTON.

HARTLEY & SUGDEN, LIMITED, HALIFAX. TRADE MARK
Heating Apparatus
BOILERS
Wrot Welded Iron and Cast Iron Sectional
VERTICAL STEAM BOILERS
Apply for Catalogue.

CAST-IRON
COLUMNS,
STANCHIONS AND GIRDERS.
Head, Wrightson & Co., Thornaby, Stockton-on-Tees.

SHONE PNEUMATIC EJECTORS
FOR RAISING SEWAGE, SLUDGE, WATER, &c.
Air Compressing Machinery
FOR ALL SERVICES.
HUGHES & LANCASTER
47, VICTORIA STREET, LONDON, S.W.

WALTER SCOTT, LTD., LEEDS STEEL WORKS LEEDS, ENGLAND.
MANUFACTURERS OF . . .
Rolled Steel Joists, Channels, etc.
Mild Steel Blooms, Billets, Slabs, Tinbars, Rounds and Flats.
Speciality: **TRAMRAILS.**

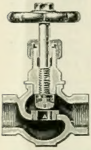
GUARDS FOR SAWS, PLANERS AND MOULDERS.
SAWMILL, FIREWOOD, and FIRELIGHTER MACHINERY.
Enormous Profits Easily Made.
M. GLOVER & CO., Patentees, **LEEDS.**

Rochester Card
Bundy Key
Signature
Journey
Speed
RECORDERS.
For further particulars . . of our . .
TIME RECORDERS
see our whole page Ad. on March 17th.
RECORDERS, LTD., 171, Queen Victoria Street, LONDON, E.C.

WE
WELCOME
ALL VISITORS TO
OUR WORKS
WHO ARE INTERESTED IN
LATHES.
JOHN LANG & SONS, Johnstone, nr. GLASGOW.

Write for Prices and Particulars
. . OF OUR . .
NEW "STANDARD" MACHINES.
They will interest you.
Dynamos "P.D.M." Motors
BEST MATERIAL, WORKMANSHIP AND DESIGN.
PHŒNIX DYNAMO MFG. CO., Ltd.,
Thornbury Works, BRADFORD.
LONDON OFFICE: 17, Victoria St., Westminster, S.W.
Telegraphic Address: "Phedyna, London." *Telephone:* 1061 Victori

PAGE'S WEEKLY Miscellaneous



The "SHAW" Patent Steam Valves . .

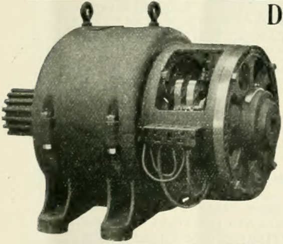
With Renewable Seats, Interchangeable Concentric Valve, Compound Packing to Spindle, Special Metal, and High-Class Workmanship.

The "SHAW" Patent Parallel Slide Valve is the Acme of Simplicity and Durability.

Try Them ! Sent on Approval.

☞ *Write for particulars of these and other Specialities for High Pressure Steam.*

JOSEPH SHAW, B Dept., Albert Works, HUDDERSFIELD.



Dynamos
AND
Motors
for all purposes.

NEWTON BROS.,
DERBY.

Telegrams:- "EBONESTOS LONDON"

B. WEAVER & Co

Patentees & Manufacturers of

The "EBONESTOS" INSULATOR

Regd No 23226.

Suitable for Bushings Nipples, Switch Handles & other small Insulating Fittings.

22, Rosoman St.
Clerkenwell, LONDON, E.C. Eng.

OIL-SEED-AND-CAKE MILLS.

GRAB DREDGERS.

Rose, Downs & Thompson, LTD.,

Old Foundry, HULL,
and
12, Mark Lane, LONDON, E.C.

OIL REFINERIES.

WATER SOFTENING PLANT.

Refuse Destructors.

Write for particulars to :—

HEENAN & FROUDE, LIMITED,

4 Chapel Walks, MANCHESTER.

Works: MANCHESTER and WORCESTER.

Contractors to H.M. Government.

BRADBURY & CO., LTD.

Capstan Lathes and Labour Saving Tools.

TRADE MARK
BRADBURY & COMPANY LIMITED
WELLINGTON WORKS OLDHAM
DUKE OF WELLINGTON

WELLINGTON WORKS,
OLDHAM.

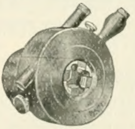
Lists Free.

HIGH-CLASS
NEW MACHINE TOOLS
IN STOCK FOR IMMEDIATE DELIVERY.

THOS. W. WARD, LIMITED,

Send for Catalogue (post free).

ALBION WORKS,
SHEFFIELD.



HARTNESS
AUTOMATIC OPENING DIE

The most satisfactory means yet devised for the production of screw threads.

JONES & LAMSON MACHINE CO.,
JUBILEE BUILDINGS,
97, Queen Victoria Street, LONDON.

PAGE'S WEEKLY Contracts

CONTRACTS.

WESTERN VALLEYS (MON.) SEWERAGE BOARD.

CONTRACT No. 1.

CONSTRUCTION OF MAIN OUTFALL AND BRANCH SEWERS.

Notice is Hereby Given that the Western Valleys (Mon.) Sewerage Board are prepared to receive TENDERS for the CONSTRUCTION of the above WORKS, consisting of the Main Outfall Sewer, Tank Sewer, and Sea Outfall, from Aberbeeg to low-water mark in the Bristol Channel, about 17½ miles in length varying from 2ft. 6in. to 11ft. in diameter, of brick, concrete, cast iron and steel; the Nantyglo Branch, from Nantyglo to Aberbeeg, about 6½ miles in length, varying from 12in. to 21in. in diameter, of earthenware and steel pipes; the Cwmtillery Branch, about 1¼ miles in length, 12in. and 15in. in diameter, of earthenware and steel pipes; the Ebbw Vale Branch, from Beaufort to Aberbeeg, about 8½ miles in length, varying from 12in. to 18in. in diameter, of earthenware and steel pipes; being a total length of about 35 miles, together with Penstock Chamber, Manholes, Chambers, Inspection Shafts, Ventilators, Penstocks, Storm Overflows, Connecting Chambers, and Miscellaneous Works in connection therewith.

Drawings and Specification of the Works may be seen at my offices as below, at the offices of Mr. BALDWIN LATHAM, M.Inst.C.E., Parliament Mansions, Victoria Street, Westminster, and Mr. GEORGE CHATTERTON, M.Inst.C.E., 6, The Sanctuary,, Westminster.

A limited number only of the quantities, specifications, schedules, and forms of Tender are available, and may be obtained from the above Engineers, on deposit of £25 (crossed cheque only), which will be returned, after a contract has been entered into, to every person who has sent in a *bonâ fide* Tender, and has returned the documents entrusted to him.

Sealed Tenders on the forms supplied, endorsed "Tender for——— Sewerage Works, Contract No. 1," are to be delivered at my offices, 24, Stow Hill, Newport, Mon., on or before 11 a.m., on Saturday, the 8th day of April, 1905.

The Board do not bind themselves to accept the lowest or any Tender.
Dated this 10th day of February, 1905.

T. S. EDWARDS,
Clerk to the Western Valleys (Mon.) Sewerage Board.
24, Stow Hill, Newport, Mon.

AXBRIDGE UNION RURAL DISTRICT COUNCIL.

HIGHBRIDGE WATER SUPPLY.

CONTRACT No. 1.

TENDERS are invited for SUPPLYING about 600 TONS of CAST IRON SOCKET WATER PIPES, 7in. to 4in. in diameter, to be delivered at Axbridge and Highbridge Station, or other specified place.

Specification and Quantities, with form of Tender, may be obtained from the Engineer, A. POWELL, M.I.C.E., 3, Unity Street, College Green, Bristol, between the hours of 10 and 5, 10 to 1 Saturdays.

Sealed Tenders, endorsed "Tender for Cast Iron Pipes," to be sent to me, the undersigned, at my office, on or before the 13th day of March.

Contractors will be required to deposit £5 for bill of quantities, which sum will be returned upon receipt of *bonâ fide* Tender.

The Council do not bind themselves to accept the lowest or any Tender.

WILLIAM REECE,
Rural District Council Office, Clerk to the said Council.
Axbridge, Somerset, February 15th, 1905.

BROADSTAIRS AND ST. PETER'S URBAN DISTRICT COUNCIL.

RUMFIELDS PUMPING STATION.

PUMPING MACHINERY.

TENDERS are invited for the CONSTRUCTION, DELIVERY, and ERECTION at the above Station of a HORIZONTAL TANDEM COMPOUND ENGINE, CONDENSER, WELL PUMPS, and all accessories.

Copies of the Specification and Plans can be obtained at the office of the Council's Consulting Engineer, Mr. PERCY GRIFFITH, M.Inst.C.E., F.G.S., 54, Parliament Street, Westminster, S.W., on payment of a deposit of £5, which will be returned to those from whom *bonâ fide* Tenders shall have been received on or before the date hereafter named.

Early application is necessary, as only a limited number of copies will be issued to contractors.

Sealed Tenders, on the form provided for the purpose, must be delivered at the Offices of the Council, on or before the 11th March, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
L. A. SKINNER,
Council Offices, Broadstairs, Clerk of the Council.
February 16th, 1905.

BRUMBY AND FRODINGHAM WATER SUPPLY.

The Brumby and Frodingham Urban District Council invite TENDERS for the MANUFACTURE and DELIVERY of about 650 TONS of CAST IRON WATER PIPES and IRREGULARS, of diameters ranging from 7in. to 3in.

Specifications and forms of Tender may be obtained from Mr. ALFRED ATKINSON, C.E., of Brigg, on payment of a deposit of £2, which will be returned on receipt of a *bonâ fide* Tender, accompanied by the documents.

Sealed Tenders, on the forms supplied, endorsed "Tender for Pipes," must be delivered at my office not later than the 10th March, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

G. S. SOWTER,
Brigg, February 15th, 1905. Clerk to the Council.

UXBRIDGE URBAN DISTRICT COUNCIL.

Subject to the sanction of the Local Government Board for the necessary loans being obtained:

The Council invite TENDERS for the REMOVAL of existing BOILERS, ENGINE, and PUMPS, and for the SUPPLYING and FIXING of a set of THREE-THROW WELL PUMPS, ONE VERTICAL COMPOUND SURFACE-CONDENSING ENGINE, TWO CORNISH BOILERS, with Superheaters, Economiser, and all necessary pipe connections, in accordance with the printed Specification, copies of which may be obtained from the office of the Engineer Mr. F. S. COURTNEY, M.Inst.C.E., 25, Victoria Street, Westminster, where also the plans may be inspected, or from the Clerk to the Council, upon the deposit of £5 5s., which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders to be delivered on or before 12 o'clock on Saturday, the 11th of March, 1905, to W. T. HARVEY, Esq., Clerk to the Urban District Council, 126, High Street, Uxbridge, endorsed "Tender for Pumping Machinery."

W. T. HARVEY,
Clerk to the Board.

The Council do not pledge themselves to accept the lowest or any Tender.

WIMBLEDON URBAN DISTRICT COUNCIL.

ENGINEER AND SURVEYOR'S DEPARTMENT.

THE WIMBLEDON URBAN DISTRICT COUNCIL invite TENDERS for the SUPPLY and FIXING of a PUMP to raise Sewage Sludge.

Specifications and conditions to be obtained on application to C. H. COOPER, M.I.C.E., Engineer and Surveyor to the Council, Council Offices, Broadway, Wimbledon.

Tenders, endorsed "Sludge Lift," and addressed to the "Chairman of the Road and Drainage Committee," must be delivered at this office on or before noon on Saturday, the 11th day of March, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
C. H. COOPER, M.I.C.E.,
Engineer and Surveyor.
Council Offices, Broadway, Wimbledon,
February 21st, 1905.

COUNTY BOROUGH OF SOUTH SHIELDS.

CORPORATION ELECTRICAL SUPPLY AND TRAMWAYS DEPARTMENTS.

The CORPORATION of South Shields are prepared to receive TENDERS for the SUPPLY, DELIVERY, and ERECTION of the FOLLOWING PLANT in connection with the

ELECTRICITY SUPPLY DEPARTMENT.

CONTRACT No. 67.—One Multitubular Marine Type Boiler, with Chimney and Mountings.
" " 68.—Two Medium-Speed Open-Type Vertical Engines for 2,550-kw. Direct-Current Traction Generators.
" " 69.—Two 550-kw. Direct-Current Traction Generators.
" " 70.—Traction Switchboard.

TRAMWAYS DEPARTMENT.

CONTRACT No. 4.—Electric Tramcars, complete with "Brill" Trucks.

Copies of Specifications, Conditions, Form of Tender, also Form of Contract, can now be obtained from Mr. J. H. CAWTHRA, M.I.E.E., Borough Electrical Engineer, South Shields, on payment of Two Guineas for each Contract, which sum will be returned on receipt of a *bonâ fide* Tender for each Contract.

Tenders on the form supplied, sealed and endorsed "Tender for Boilers, Engines, Generators, Switchboard, or Tramcars," as the case may be, must be delivered to me at my offices, Court Buildings, South Shields, on or before noon of the 13th March, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

J. MOORE HAYTON, Town Clerk.
February 3rd, 1905.

PAGE'S WEEKLY Contracts

GREAT WESTERN RAILWAY.

The DIRECTORS of this Company are prepared to receive **TENDERS** for the **SUPPLY, DELIVERY, and ERECTION** of the **FOLLOWING PLANT** in connection with their Electricity Generating Station at Park Royal and proposed Sub-Stations and Distributing Centres at various places:—

SPECN. 11.—High and Low Tension 3-Phase and Direct-current Switch-boards and Battery Boosters at Park Royal. All Sections must be tendered for.

SPECN. 14.—3-Phase Static Transformers and High and Low Tension Switch-boards at various Sub-stations and Lighting Distributing Centres between Paddington and Park Royal and Paddington and Hammersmith. All Sections must be tendered for.

SPECN. 15.—High and Low Tension 3-Phase and Direct-Current Switchboards at Royal Oak, Shepherd's Bush, and Old Oak Common Sub-stations.

- Sec. A.—3-Phase Switchboards.
- „ B.—Direct Current Switchboards.
- „ C.—Six Motor-driven Boosters (Four Reversible and two Milking) in connection with Storage Batteries at Royal Oak and Shepherd's Bush Sub-stations.

All Sections should be tendered for if possible, but Tenders for Section A alone or for Sections B and C together will be considered. The Company reserve the right of accepting a Tender for any one of the different Sections alone.

Copies of the Specifications, Forms of Tender, Drawings and General Conditions can be obtained on and after Tuesday, the 14th instant, at the offices of the Consulting Engineers, Messrs. KENNEDY AND JENKIN, 17 Victoria Street, London, S.W., between the hours of 10 a,m. and 4 p.m., on payment of Two Guineas for each Specification, which will be refunded on the receipt of a *bonâ fide* Tender. The fee, which must be paid by cheque, will not be returnable until the Tenders have been adjudicated upon.

Tenders, addressed to "The Secretary, Great Western Railway, Paddington Station, W.," and marked outside "Tender for Electric Power and Lighting—Specification No. '11,' '14,' or '15,'" as the case may be, will be received on or before Monday, March 13th.

The Directors do not bind themselves to accept the lowest or any Tender, and no allowance will be made for any expense incurred in the preparation of a Tender.

G. K. MILLS,
Secretary.

Paddington Station, London, February 8th, 1905.

BOROUGH OF MARGATE.—WATER-WORKS DEPARTMENT.

TENDERS are invited for the **SUPPLY** of all or any of the **ARTICLES** mentioned in the following **SCHEDULES** for the year commencing April 1st, 1905:—

SCHEDULE No. 1. Cast-Iron Pipes and Special Castings.
„ „ 2. Valves, Hydrants, Fittings, and Surface Boxes.
„ „ 3. Wrought-Iron and Steel Tubing and Fittings.
„ „ 4. Yellow Metal Fittings.
„ „ 5. Miscellaneous Stores (Oil, Tallow, &c.)

Applications for Schedules and Forms of Tender (upon which alone Tenders will be received) should be made to the Engineer, Mr. N. McK. BARRON, C.E., 15, Cecil Square, Margate.

Sealed Tenders, endorsed "Tender for——" as the case may be, must be delivered at my office not later than One o'clock p.m. on Monday, the 6th March, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of accepting such Tenders or parts thereof as they may think fit.

Samples must be forwarded to the Engineer as above carriage paid.

EDWARD BROOKE,
Town Clerk.

Town Clerk's Office, Margate,
February 20th, 1905.

METROPOLITAN BOROUGH of STOKE NEWINGTON.

ELECTRIC LIGHTING.

The Council of the Metropolitan Borough of Stoke Newington are prepared to receive **TENDERS** for the Supply, Delivery, and Erection of the following Sub-station Plant and Mains:—

Section 1.—TRANSFORMERS, THREE-PHASE MOTOR-GENERATORS, BOOSTERS, &c.

Section 2.—Extra H.T. and three-wire L.T. SWITCHBOARDS.

Section 3.—STORAGE BATTERY.

Section 4.—L.T. DISTRIBUTION MAINS.

Contractors may tender for one or more of the above sections, but not for part of a section.

Specifications and plans may be seen at the Offices of the Engineers, Messrs. TALBOT AND STEVENSON, 26, Victoria Street, London, S.W., but copies of these with general conditions and form of Tender may be obtained only at the offices of W. F. LOVEDAY, Esq., Borough Surveyor, Town Hall, Milton Road, Stoke Newington, N., on or after the 6th day of February, on deposit of cheque value One Guinea for each section, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders endorsed "Section———, Electric Lighting," are to be addressed to the Electric Lighting Committee, and must be delivered at the Town Hall, Milton Road, Stoke Newington, N., at or before 4 o'clock p.m. on Wednesday, the 8th day of March, 1905.

By order, GEORGE WEBB, Town Clerk.

HAMMERSMITH BOROUGH COUNCIL.

TO ENGINEERS AND CONTRACTORS.

The Borough Council invite **TENDERS** for the **CONSTRUCTIONAL STEELWORK**, &c. required in the Erection of Additions to Boiler-House and Steel Coal Bunkers, at the Borough Electricity Works, 85, Fulham Palace Road, W.

Plans of the intended Works may be seen, and a copy of the Specification and Bills of Quantities, with the Forms of Tender, can be obtained on application to Mr. H. MAIR, M.I.C.E., Borough Surveyor, upon payment of 21s., which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders, endorsed "Tender for Boiler-House," must be delivered to me not later than 6 p.m. on Wednesday, March 8th, 1905.

The Council does not bind itself to accept the lowest or any Tender.

H. THOMPSON,
Town Clerk.

Town Hall, Broadway, Hammersmith,
February 18th, 1905.

GREAT NORTHERN RAILWAY COMPANY (IRELAND).

The Directors are prepared to receive **TENDERS** for the **SUPPLY** of **3,000 TONS** of 90lb. **STEEL BULLHEAD RAILS**, with the necessary Fish-plates, and 2,000 **TONS** of **CAST IRON CHAIRS**.

Specifications and forms of Tender can be obtained from the Secretary on payment of 1s. each.

Tenders should be delivered to the undersigned not later than 10 a.m. on Monday, the 6th March, 1905.

The Directors do not bind themselves to accept the lowest or any Tender.

T. MORRISON,
Secretary.

Secretary's Office:
Amiens Street Terminus, Dublin,
February 15th, 1905.

APPOINTMENTS OPEN.

CITY OF LEEDS.—THE CORPORATION

are about to design and carry out a scheme for the disposal of the sewage of the city, and to promote a Bill in Parliament to obtain the necessary powers, and they now desire to appoint an **ENGINEER**, who will have charge of the construction of the works. His duties will be to become thoroughly acquainted with the present system and with the experiments which have been carried on; to consider the scheme which has been suggested to the Committee, and to advise them thereon and on any alternative system; to prepare the necessary Parliamentary plans and estimates for the construction of the works, and carry out such instructions as may from time to time be given to him in connection with the promotion of the Bill in Parliament and all other matters connected with the disposal or the sewage of the city; to prepare all working plans and drawings, to make all necessary surveys, to prepare bills of, quantities and specifications, and carry out or continue the carrying out of the works. He will have to work under any consulting engineer if the Committee should decide to retain one to advise them, but in all other respects he will be responsible to the Committee alone.

The remuneration will be £1,000 a year, with an office in the Municipal Buildings, and the assistance of such staff as in the opinion of the Committee may be necessary.

Applications, with three copies of testimonials, and endorsed "Sewerage Engineer Application," to be sent to the undersigned not later than Saturday, March 11th next.

Canvassing members of the Corporation, directly or indirectly, is prohibited.

ROBERT E. FOX,
Town Clerk.

February, 1905.

BOMBAY, BARODA, AND CENTRAL INDIA RAILWAY.

The Directors are prepared to receive **APPLICATIONS** (by letter only) from duly qualified candidates for **APPOINTMENT** as an **ASSISTANT CARRIAGE** and **WAGON SUPERINTENDENT** in the service of the Company in India.

Candidates should not be more than 35 years of age, and must have had a good general and technical education.

Other qualifications being equal, preference will be given to candidates who have served their time in the carriage shops of a railway company, or of a large railway carriage and wagon builder in the United Kingdom.

A knowledge of electricity is desirable, but a candidate must have a thorough knowledge of woodworking, general machine, smithy, and hydraulic tools.

Terms: A five years' agreement, with first-class free pasage to India.

Salary: Rs. 600 per calendar month.

The candidate selected will have to pass a medical examination by the Company's consulting physician before appointment.

Letters of application, accompanied by a brief record in chronological order of the candidate's career, with dates and copies (not originals) of testimonals, marked outside "Assistant Carriage and Wagon Superintendent," should be addressed to the undersigned not later than 15th of March next.

T. W. WOOD,
Secretary.

Offices, Gloucester House,
Bishopsgate Street Without, London, E.C.
February 22nd, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street. City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.
John Thompson, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co., 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield,
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.
E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34. Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Mirrlees Watson Co., Ltd., Glasgow.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C,

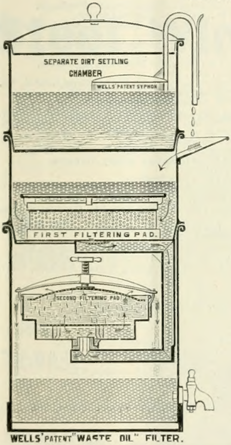
Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

PAGE'S WEEKLY Wells' Specialities

WELLS' PATENT "Waste Oil" FILTERS

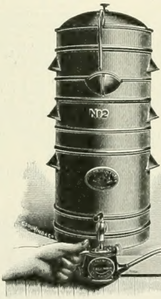
FITTED WITH SIGHT-FEED SYPHON.



WELLS' PATENT "WASTE OIL" FILTER.

SUPPLIED TO THE PRINCIPAL GOVERNMENTS FOR THE NAVY, DOCKYARDS, &c., AND TO THE LEADING ELECTRIC LIGHT INSTALLATIONS, ENGINEERING WORKS, GAS ENGINE MAKERS, PRINTERS, &c., &c.

OVER *10,000* SOLD.



MONEY SAVERS to any USERS OF MACHINERY.

Pay first cost in a short time, as Dirtied Oil, which has hitherto been thrown away, can be filtered and used again and again.

Write for List of Testimonials and Samples of Work done by the Filter.

No. 1.—For users having only a small quantity of oil to treat (no syphon) 17 in. by 9 in.	35/-
No. 2.—Two top chambers hold about 3 gallons oil, 22 in. by 10 in. ..	50/-
No. 3.—Two top chambers hold about 6 gallons oil, 27 in. by 12 in. ...	70/-
No. 4.—Two top chambers hold about 12 gallons oil, 36 in. by 16 in. ...	110/-
No. 5.—Two top chambers hold about 24 gallons oil, 43 in. by 23 in. ...	189/-
No. 6.—Very powerful Filter for treating large quantities of oil, 54 in. by 30 in.	336/-

Capable of dealing with **250** Galls. Oil per week

LARGER SIZES MADE TO ORDER.

NO OUTSIDE POWER REQUIRED.

LIME, WHITING, OR COLD WATER PAINTS,

Applied at a speed of from 8 to 10 square yards per minute, in a manner superior to brush work.

One coat with the Machine on rough surfaces is equal to two applied with brushes.

Will save First Cost in a Few Days.

No. 6.	Handy Size. No Tank. On Wheels.	£7 7s.
No. 4.	Price, with 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose. Capacity 6 gals.	£8 10s.
No. 4A.	Price, with Wheels, 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose, **Same capacity as No. 4 Machine.**	£9 10s.
No. 5.	With 5-ft. Pole, Double Spraying Nozzle, and 20 ft. Special Armoured Hose, Large Size. Capacity 10 gals.	£10 10s.
No. 5A.	Ditto Ditto fitted with Wheels.	£11 15s.

WELLS' IMPROVED LIMEWASH.

MUCH SUPERIOR TO ORDINARY LIMEWASH. SLAKED WITH WATER. QUICKLY MIXED. WILL NOT RUB OFF. LEAVES A GOOD SURFACE.

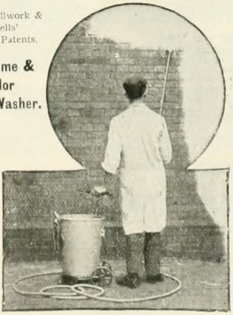
Price 13/8 per cwt.,
Carriage Paid in England and Wales. (If in lots of 3 cwt. at a time, 12/8 per cwt.)

A. C. WELLS & Co.,
100a, Midland Road, St. Pancras,
Works: Cheetham, Manchester. LONDON, N.W.

WELLS' "LIGHTNING"

Wallwork & Wells' Patents.

Lime & Color Washer.



No. 4a, with Wheels.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co,, Derby.
Purden, John & Sons, Lambhill Forge, by Ma hill Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Britannia Engineering Co., Ltd., Colchester, England.
Chas. Churchill & Co., Ltd., 9-15, Leonard Street, London, E.C.
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund. Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
John Stirk & Sons, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Winn, Charles. & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co., Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W C

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

BULLIVANTS'

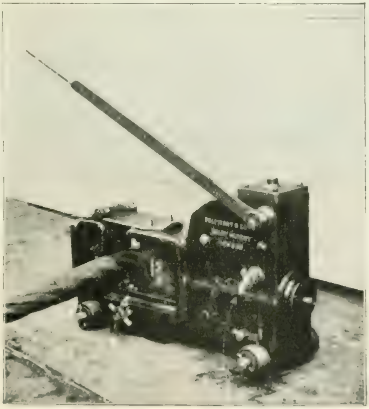
Steel Wire Mining Ropes.

Wire Ropes for Hauling and Winding Gear,
and all operations connected with Mining.

CRANE ROPES,

LIFT ROPES,

HAULING ROPES,



BLOCKS,

PULLEYS,

CRAB WINCHES,

AND ALL

WIRE ROPE APPLIANCES.

Patent Hydraulic Rope-Cutting Machine (SELBY PATENT)

With this Machine a man can cut up to 9-in. circ. wire rope without assistance in about one minute.

RAPID. SIMPLE. PORTABLE. LABOUR SAVING.

Prices and all Particulars on application to Sole Manufacturers :—

BULLIVANT & CO., Ltd., Works MILLWALL, E.

Telephone No. : 239 EASTERN.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery London, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.

Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles Bement-Pond Co., 23 25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Greenwood & Batley, Albion Works, Leeds.
Niles Bement Pond Co., 23 25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd., Cambridge.

Stampings.

Thos. Smith's Stamping Works, Ltd., Coventry.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, [illegible], West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23 25, Victoria Street, London, S.W.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 10, St. George's Crescent, Liverpool, and 100c Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Water Softeners.

Lassen & Hjort, [illegible] Queen Victoria Street, London, E.C.

Weighing Apparatus.

W. T. Avery & Co., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.

A. C. Wells & Co., [illegible], Midland Road, St. Pancras, London, N.W.

Wind and Water Supply Machinery.

Eric S. A. Smith, [illegible].

Wire Working Machinery.

Ed. [illegible], [illegible] Street, Manchester.

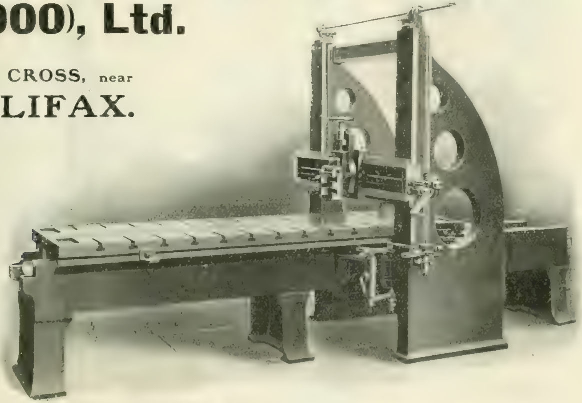
"Woodite."

"Woodite" Company, Mitcham, Surrey.

PAGE'S WEEKLY Machine Tools, &c.

Northern Engineering Co. (1900), Ltd.

KING CROSS, near
HALIFAX.



PLANING
MACHINE,
from 2 feet
up to 8 feet
square.

GREENWOOD & BATLEY, Ld.

LEEDS.

Machine Tools.

Dynamos & Motors.

De Laval's Patent
Steam Turbines.

Cunliffe & Croom, Ltd.,

BROUGHTON LANE,
Manchester.

[illegible]

Brass Finishers.

[illegible]

CHARLES GRIFFIN & CO.'S PUBLICATIONS.

[illegible] 24s. net.

CENTRAL ELECTRICAL STATIONS:
Their Design, Organisation, and Management.
By CHAS. H. WORDINGHAM, A.K.C., M.I.C.E., M.I.M.E.

[illegible]

[illegible] 12s. 6d. net.

ELECTRICITY CONTROL.
A Treatise on Electric Switchgear and Systems of Electric Transmission.
By LEONARD ANDREWS, A.M.I.C.E., M.I.E.E.

[illegible]

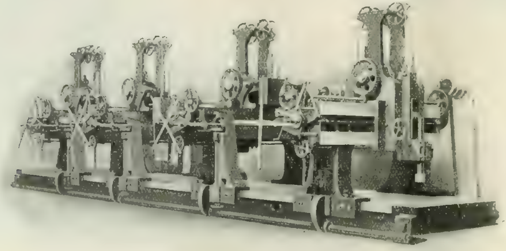
London: CHARLES GRIFFIN & CO., Ltd., EXETER STREET, STRAND, W.C.

PAGE'S WEEKLY Machine Tools

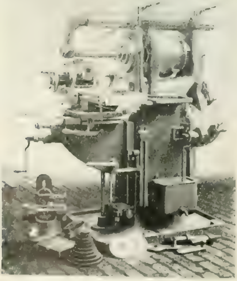
JOHN STIRK & SONS,

MACHINE TOOL MAKERS,

(Established 1866.) **HALIFAX.**



Locomotive Frame-plate Slotting Machine (85 tons).



No. 2 Gear Feed Universal Miller.

J. Parkinson & Son,

SHIPLEY, ENGLAND.

JOHN GIBBS & SON

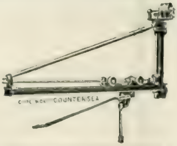
Ventilating Engineers,

80, JUKE STREET,
LIVERPOOL.

Say Advertising does not pay

SEE OUR ILLUSTRATED ADVERTISEMENT NEXT WEEK.

BERTRAMS LIMITED



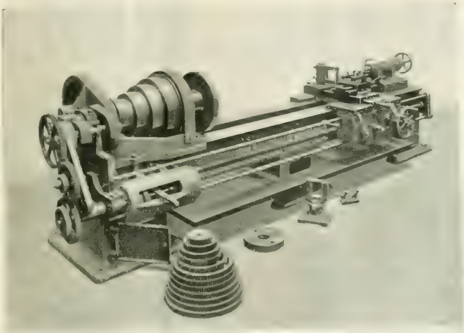
Radial Counter Sinking Machine

St. Katherine's Works,
Sciennes,
EDINBURGH.

London Office:
MOORGATE
STATION
CHAMBERS, E.C.

MACHINE TOOLS For Engineers, Shipbuilders, Boiler Makers, etc., etc.

PAGE'S WEEKLY Machine Tools



WE MAKE
HIGH-SPEED
LATHES
A Speciality.

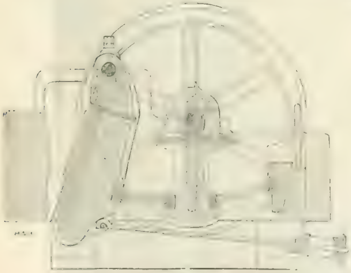
"ACCURATE."
"DURABLE."
"POWERFUL."
8½in., 10in., and 12in.
Centres.

REASONABLE IN PRICE.
UNEQUALLED IN POWER.

Send us your
Inquiries.

NOBLE & LUND, LIMITED,
FELLING-ON-TYNE.

STONE BREAKERS.
(Improved Blake Type.)



Section of Machine

Rollers,

Screens,

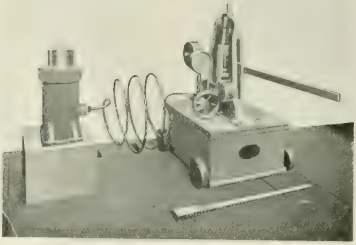
Gravel Washers,

Concrete Mixers.

SAMUEL PEGG & SON,
National Telephone 184. Alexander Street, LEICESTER, ENGLAND.

PAGE'S WEEKLY Machine Tools

HYDRAULIC TOOLS.



BOILER FLUE APPARATUS.

This illustration shows an apparatus for pushing up boiler flues. The cylinder and ram can be got into a flue of 24 in. diameter, and is capable of dealing with plates up to ¾ in. of thickness cold.

Prices and Particulars on Application.

~

RICE & CO.

(Leeds), Ltd.,

ELLAND RD., LEEDS.

Telegraphic Address: "PRESS, LEEDS."
A B.C. Code, 5th Edition used
National Telephone: 2362.

BATEMAN'S MACHINE TOOL Co., LTD.,

Makers of . . .

HIGH-SPEED PLANERS ONLY

Address: **Hunslet, LEEDS.**

OUR PATENT MACHINES

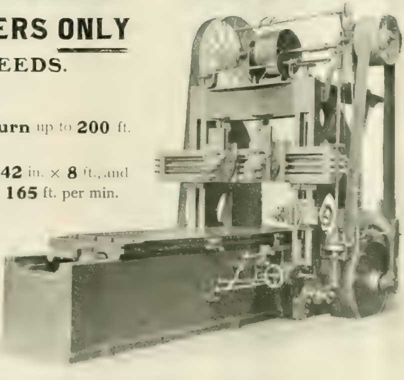
Cut up to **80** ft. per min. and **Return** up to **200** ft. per min. according to size.

The Machine illustrated is a **42** in. × **42** in. × **8** ft., and **Cuts** at **60** ft. per min., **Returns** at **165** ft. per min.

With Two Tools at ⅛ in. feed, it will plane **4,032** sq. in. in **30** to **35** mins.

With a cut [illegible] in. deep, at ⅛ in. feed, it will remove nearly **½-TON** of metal per **hour.**

Our **60** in. × **60** in. × **12** ft. Planer **Cuts** at **60** ft. per min., **Returns** at **130** ft. per min.

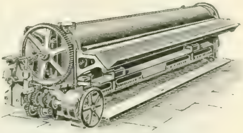


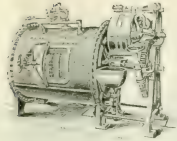
42 in. × 42 in. × 8 ft PATENT HIGH-SPEED PLANER.

PAGE'S WEEKLY Machine Tools

Laundry Machinery

AND **COOKING APPARATUS.**



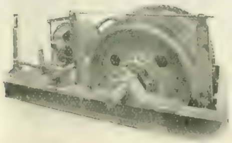


W. Summerscales & Sons, Ltd.

CATALOGUE
ON APPLICATION.

Phœnix Foundry, KEIGHLEY, ENGLAND.

Electric Hauling GEARS



Main and Tail, Main Rope, Endless Rope, and Portable, Hoisting, and Hauling Gears.

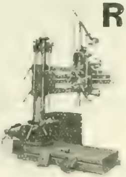
M. B. WILD & CO., 35 and 36, Clarence Chambers, Corporation Street,
BIRMINGHAM.

HIGH-CLASS LATHES

AND

RADIAL DRILLS.

Write for our Lists.



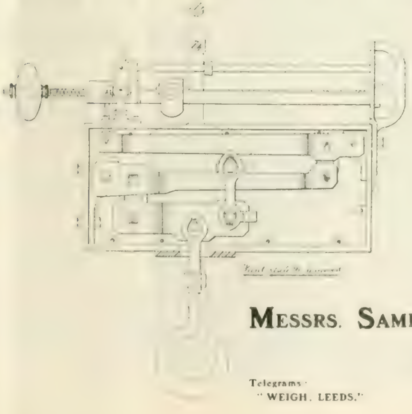
D. MITCHELL & CO., Ltd.

Parsonage Works, KEIGHLEY.

Telegrams: "Tools, Keighley."

On War Office and India Office Lists.

WEIGH AS YOU LIFT.



Amply Safe,

POSITIVELY
ACCURATE.

MESSRS. SAML. DENISON & SON, LIMITED.

Hunslet Moor,
Near LEEDS.

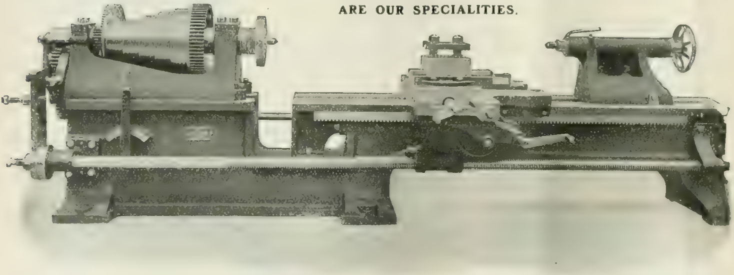
Telegrams:
"WEIGH, LEEDS."

PAGE'S WEEKLY Machine Tools, &c.

DON'T FORGET

Lathes, Planers, and Shapers

ARE OUR SPECIALITIES.



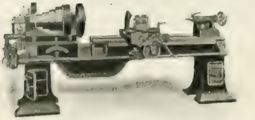
High-Grade Machines Only in Stock for Immediate Delivery.

C. Redman & Sons,

National Telephone: 308.
Telegrams: "REDMANS, ENGINEERS, HALIFAX."

HALIFAX.

HIGH SPEED LATHES



Our Speciality up to 12-in. Centre.

Price List on application.

ACCURACY GUARANTEED.

Telegrams
"Leckenby, Benton Halifax."

LECKENBY, BENTON, & CO.,
Perseverance Ironworks, HALIFAX.

MACHINE TOOLS,

Special & General

For Engineers, Shipbuilders, Boiler Makers, Girder Makers, and Bridge Builders.

G. F. SMITH,
LIMITED,
South Parade,
HALIFAX.

Telegrams: [illegible] Halifax.

W. & O. GILMOUR,

Machine Belt Manufacturers,

St. John's Hill,
EDINBURGH.

Telegrams: "BELTING, EDINBURGH." Telephone No. [illegible] Central.

Belting

MADE FROM

PURE OAK TANNED LEATHER.

Quality is Our First Consideration.

For over **Eighty Years** we have been makers of Leather Belting, but owing to the present demands of [illegible] and down [illegible] we are now [illegible] supply Oak Tanned Leather Belting at [illegible] as is consistent with first-class [illegible]

PAGE'S WEEKLY Packings

ON LAND AND SEA

"THE LANCASTER" (R.T.M.)

Metallic Packings

GIVE SURE SATISFACTION.

These Packings are used by the principal Navies and Steamship Lines of the world, and also by the largest engineers in this country and abroad.

"The Lancaster" Metallic Packings are simple—durable—reliable. They give **efficient packing** with a **minimum of friction.** They are made to stand all pressures and any degree of superheat. Write for Catalogue C, post free. **FIRST ORDERS SENT ON APPROVAL.**

LANCASTER & TONGE, Ltd.,

Makers of "The Lancaster" Pistons, Steam Traps, Steam Dryers, Grease Separators, combined with Feed Water Heaters. Feed-water Guaranteed 200 F. No tubes or other complications.

Engineers, Pendleton, MANCHESTER.

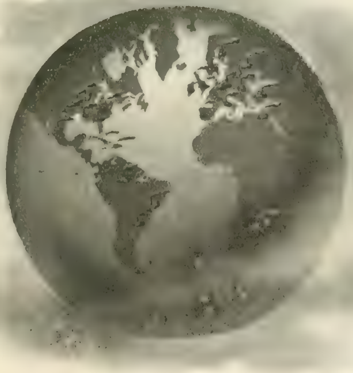
Manufacturers,
Engineers,
and
Power Plants
of every
description

ALL OVER
THE
WORLD

are using

DANIEL'S
P.P.P.
ROD
PACKING

Saving Thousands of
Horsepower



Converting Wasted Energy into Marketable Products.
If you have not used it yet, DO SO at our expense. You'll be glad about afterwards.

QUAKER
CITY
RUBBER
CO.

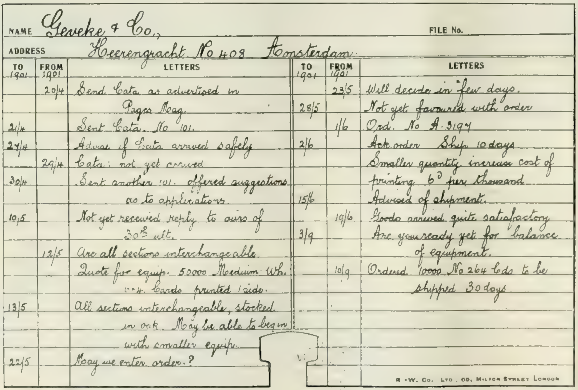
RONALD TRIST
& CO.,
General Managers

Coronation House,
Lloyd's Avenue,
LONDON, E.C.
Late of
101, Leadenhall
Street, E.C.

PAGE'S WEEKLY **Up=to=date**

CAUSE

THE



NAME Geveke & Co., FILE No.

ADDRESS Heerengracht No 408 Amsterdam.

TO 1901	FROM 1901	LETTERS	TO 1901	FROM 1901	LETTERS
	20/4	Send Cata as advertised in		23/5	Will decide in few days.
		Pages Mag.	28/5		Not yet favoured with order
21/4		Sent Cata. No 101.		1/6	Ord. No A. 3197
27/4		Advise of Cata arrived safely	2/6		Ack. order Ship 10 days
	29/4	Cata: not yet arrived			Smaller quantity increase cost of
30/4		Sent another 101. offered suggestions			printing 6^d per thousand
		as to applications	15/6		Advised of shipment.
10/5		Not yet received reply to ours of		19/6	Goods arrived quite satisfactory
		30th ult.	3/9		Are you ready yet for balance
	12/5	Are all sections interchangeable			of equipment.
		Quote for equip. 50000 Medium Wh.		10/9	Ordered 10000 No 264 Cds to be
		[illegible]4. Cards printed 1 side.			shipped 30 days
13/5		All sections interchangeable, stocked			
		in oak. May be able to begin			
		with smaller equip.			
22/5		May we enter order.?			
					R.-W. Co. Ltd., 69, Milton Street London

One of our Clients says:—

> **"We have secured twenty-five per cent. better results from our advertising through the use of the CARD FOLLOW-UP SYSTEM than we did without it."**

Every business man should acquaint himself with *BUSINESS*

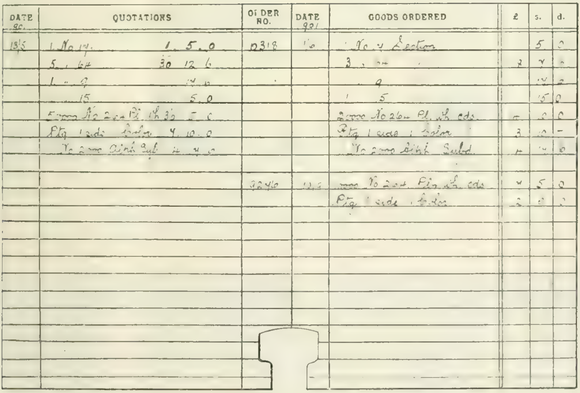
would be pleased to suggest a system adapted to the needs of

Rockwell=Wabash Co., Ltd.

PAGE'S WEEKLY Business Systems

EFFECT

STORY.



DATE 90.	QUOTATIONS	ORDER NO.	DATE 921	GOODS ORDERED	£	s.	d.
13/5	1 No 17. 1. 5. 0	0318	[illegible]	[illegible] No 4 Section		5	0
	5 „ 64 30 12 6			3 „ [illegible]	[illegible]	[illegible]	[illegible]
	1 „ 9 [illegible]			9		[illegible]	[illegible]
	„ 15 5. 0			1 5		15	0
	[illegible] No 264 Pl. [illegible]			2000 No 264 Pl. [illegible] eds.	[illegible]	[illegible]	0
	Ptg 1 side [illegible] 4. 10. 0			Ptg 1 side 1 [illegible]	3	[illegible]	–
	No 2000 [illegible] Sub [illegible]			No 2000 [illegible] Subd.	[illegible]	[illegible]	[illegible]
		3246	[illegible]	[illegible] No 264 Pl. [illegible] eds.	[illegible]	5	0
				Ptg 1 side [illegible]	[illegible]	[illegible]	[illegible]

Another Client says:—

> "It doesn't make any difference what you are trying to sell, you cannot get the full benefit of your efforts without a **CARD FOLLOW-UP SYSTEM.**"

SYSTEMS. Particulars sent on request, or, if desired, we

the particular business you are interested in.

Head Office: 69, MILTON STREET, LONDON, E.C.
Branch Offices: 50, DEANSGATE ARCADE, DEANSGATE, MANCHESTER.
164, BUCHANAN STREET, GLASGOW, N.B.

PAGE'S WEEKLY Systems for Engineers

NO ONE CAN AFFORD

in these days of severe competition when "office expense" as well as factory cost needs careful watching,

TO IGNORE

the present-day methods used by the most progressive and successful concerns.

THE TIME & MONEY

saved in one year amply repays the first "investment," which can never be reckoned an "expense," for

PERPETUAL SYSTEMS

are practically "gilt-edged securities," and their use has always been extended after a fair practical trial.

FOR FULL PARTICULARS WRITE ON YOUR BUSINESS HEADING TO P.D.L. DEPT.

THE TRADING & MANUFACTURING CO., Limited,

TEMPLE BAR HOUSE,
FLEET STREET,
LONDON, E.C.

Telegrams: "DEVISERS, LONDON."

Index to Advertisers.

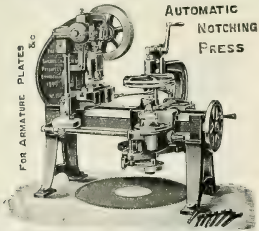
Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

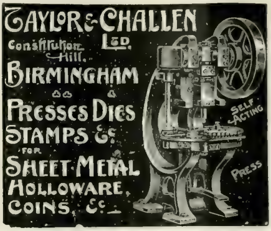
	PAGE
Addy, George, & Co.	—
Aitken, Ad.	—
Allen, Edgar & Co., Ltd.	—
Alley & MacLellan, Ltd.	—
Allgemeine Elektricitäts Gesellschaft	—
Allis-Chalmers Co.	—
Anderson & Son, Ltd., D.	
Askham Bros. & Wilson, Ltd.	—
Atlantic Press	43
Avery, Ltd., W. & T.	—
Babcock and Wilcox, Ltd.	3
Baldwin Locomotive Works	33
Burns & Son, W.	—
Bateman's Machine Tool Co.	16
Beldam Packing and Rubber Co.	
Bennis & Co., Ltd., Ed.	31
Berry & Co., Ltd., Hy.	—
Bertrams, Ltd.	14
Barnes & Son	—
Blake & Knowles Steam Pump Works	—
Bleichert & Co., A.	—
Blumann & Stern, Ltd.	24
[illegible] & Co., A.	32
[illegible] & Sullivan	—
Booth & Bros., Ltd., Joseph	—
Bradbury & Co., Ltd.	5
Brand, Ed.	3
Brett's Patent Lifter Co., Ltd.	4
Breuer, Schumacher & Co.	—
Bridge & Co., David	24
Britannia Engineering Co., Ltd.	—
British Steam Specialties, Ltd.	41
Broadbent & Sons, Ltd., Thos.	—
[illegible] T. W.	44
Brown Hoisting Machinery Co.	—
Buckley, Samuel	—
Bullivant & Co., Ltd.	
"Practical Engineer"	—
Cambridge Scientific Instrument Co., Ltd.	
Capell Fan Co.	34
Churchill & Co., Ltd., Charles	—
Clarke's Crank & Forge Co., Ltd.	
Clayton, Son, & Co., Ltd.	32
Cochran & Co. (Annan)	
Concentric Condensers, Ltd.	38
Consett Iron Co., Ltd.	—
Crompton & Co., Ltd.	
Crosby Lockwood & Son	
Crypto Electrical Co.	—
Cunliffe & Croom, Ltd.	13
Davidson & Co., Ltd.	[illegible]
Davis & Primrose	3
Deighton's Patent Flue & Tube Co., Ltd.	—
Delange & Cie, Mc	
Delta Metal Co., Ltd.	Outside Back Cover
Denison, S., & Son	1
Dobbie McInnes, Ltd.	5
Drum Engineering Co.	[illegible]
Elliott & Fry	4
Elliott-Fisher Co.	
Empire Typewriter Co.	
Engine Builders	
Enke, Carl	
Fairbanks Co.	
Fairbanks, Morse & Co.	
Fairley & Sons, James	Outside Back Cover
Farnley Iron Co., Ltd.	
Findlay & Co., Ltd., Alex.	
Firth, Ltd., William	
Fleming, Birkby & Goodall, Ltd.	—
Fowler, John, & Co. (Leeds) Ltd.	—
Fraser & Chalmers, Ltd.	
Frictionless Engine Packing Co., Ltd.	
Garrett & Sons, Ltd., R.	—
Gent & Co., Ltd.	
Gibbs, J., & Son	
[illegible] & Co., Ltd., G.	
Gilmour, W. & O.	[illegible]
Glover & Co., M.	4
Graham, Morton & Co., Ltd.	3
Grantham Crank & Iron Co., Ltd.	
Green & Son, Ltd., E.	Inside Back Cover
Greenwood & Batley, Ltd.	[illegible]
Griffin & Co., Ltd., Charles	23
Hadfield's Steel Foundry Co., Ltd.	
Hagan's Locomotive Works	
Halden & Co., J.	
Hall & Co., B. J.	
Hall & Sons, Ltd., J. P.	1
Hamilton & Co., J. B.	
Hannan & Buchanan	—
Hardisty, John	—
Hardy Patent Pick Co.	
Hartley & Sugden, Ltd.	[illegible]
Hasenclever Sohne, C. W.	
Hathorn, Davey & Co., Ltd.	
Head, Wrightson & Co., Ltd.	[illegible]
Heenan & Froude	
Holmes & Co., W. C.	
Horsfall Destructor Co.	
Howard Bros.	
[illegible] Co., S.	
Hudswell, Clarke & Co., Ltd.	Inside Front Cover
Hughes & Lancaster	1
Hughes, G. H.	3
Hunslet Engine Co.	
India Rubber, Gutta Percha and Telegraph Works Co., Ltd.	
Jones & Lamson Machine Co.	

MATTHEWS & YATES, Ltd., Swinton, Manchester.

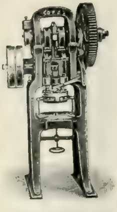
FANS FOR WATER COOLING TOWERS, &c.

PAGE'S WEEKLY Miscellaneous





TAYLOR & CHALLEN LTD.
Constitution Hill,
BIRMINGHAM
PRESSES DIES STAMPS &c.
FOR
SHEET METAL HOLLOWARE, COINS, &c.



DRAWING PRESS.

FRIED. KRUPP A.-G. GRUSONWERK, Magdeburg-Buckau.

CRUSHING and MINING MACHINERY.

Stone Breakers, Stamp Batteries, Roller Mills, Edge Runners, Ball Mills, TUBE MILLS, Amalgamating, Concentrating and Leaching Plant.

Large Testing Station at the Works.

Sole Representative for Great Britain and Ireland: **W. STAMM,** 25, College Hill, Cannon Street, LONDON, E.C.

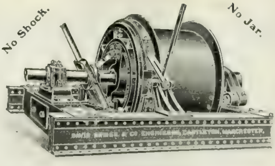
HEYWOOD & BRIDGE'S **PATENT FRICTION CLUTCH** and SHAFT COUPLING.

WE MAKE CLUTCHES, SHAFTING, GEARING and HAULING INSTALLATIONS *A SPECIALTY.*

Sixty Page Work—Free.
DON'T MISS THIS

Prevents Accidents.

No Shock. No Jar.



Hauling Made Reliable.

Patentees and Sole Makers:
DAVID BRIDGE & CO.,
Castleton Iron Works,
ROCHDALE, LANCS.

London Office
35, Queen Victoria Street, E.C.

HIGH-CLASS LUBRICANTS FOR MACHINERY OF EVERY DESCRIPTION.

LAND and MARINE ENGINE and CYLINDER OILS.
DYNAMO and GAS ENGINE OILS.
CRANK CHAMBER and STEAM TURBINE OILS.
MOTOR and CYCLE OILS.
SOLIDIFIED OILS and GREASES for all PURPOSES.

BLUMANN & STERN, LTD., Plough Bridge, Deptford, LONDON, S.E.
Contractors to H.M. Government, Home and Foreign Railways, &c.

Index to Advertisers—(Cont.)

	PAGE
Keep, F. A., Juxon & Co.	34
Keith, J., & Blackman Co., Ltd.	—
Klinger & Co., Richard	—
Krupp, Fried.	24
Lancaster & Tonge, Ltd.	19
Lang & Sons, John	4
Lassen & Hjort	40
Leckenby, Benton & Co.	18
Leeds Forge Co., Ltd.	—
Lepard & Smiths, Ltd.	—
Luke & Spencer, Ltd.	—
Lyle Co., Ltd.	41
Mabie, Todd & Bard	26
Magnesia Coverings, Ltd.	—
Magnolia Anti-Friction Metal Co., Ltd.	—
Marion & Co., Ltd.	—
Mason, Ltd., W. F.	—
Mather & Platt, Ltd.	39
Matthews & Yates, Ltd.	23
Meldrum Bros., Ltd.	30
Melling, J. F.	—
Melville and Macalpine	3
Metallic Paint Co., Ltd.	44
Miller & Co., Hy.	—
Mirrlees Watson Co., Ltd.	29
Mitchell, D., & Co., Ltd.	17
Mix & Genest	—
Nalder Bros., & Thompson	—
New Anglo-American Machine Brush Syn.	—
New Zealand Mines Record	
Newton Bros.	5
Nicholson Tool Co., Jos. C.	—
Niles-Bement-Pond Co.	—
Noble & Lund, Ltd.	15
Northern Engineering Co. (1900), Ltd.	13
Northern Railway of France	—
Nye, Arthur W.	—
Page & Rowlingson	3
Parker Foundry Co.	
Parkinson & Son, J.	14
Partridge & Cooper, Ltd.	—
Pearson, E. J. & J.	—
Pegg & Son, S.	15
Perrin, Ltd., H. W.	35
Phœnix Dynamo Mfg. Co., Ltd.	4
Phosphor Bronze Co., Ltd.	—
Piggott & Co., Ltd., Thos.	—
Positive Rotary Pumps, Ltd.	38
Power-Gas Corporation, Ltd.	Outside Back Cover
Pratt & Whitney Co.	—
Premier Boiler Tubes, Ltd.	—
Pryor & Son, Edward	4
Purden & Sons, John	—
Quaker City Rubber Co.	19
Recorders, Ltd.	4
Redfern & Co., S.	—
Redman & Sons, C.	18
Reliance Lubricating Oil Co.	—
Renshaw & Co., Ltd., W. R.	35
Rice & Co. (Leeds) Ltd.	[illegible]
Richardsons, Westgarth & Co., Ltd.	—
Richter, Gustav	—
Riter Conley Manufacturing Co.	
Robinson & Co., Ltd., T. D.	
Rockwell-Wabash Co., Ltd.	20 & 21
Roller, A.	
Rose, Downs & Thompson, Ltd.	5
Rossendale Belting Co., Ltd.	—
Rubber Stamp Co.	36
Ryder, Ltd., William	—
St. Helen's Cable Co., Ltd.	—
Samson & Co.	
Sankey & Son, J. H.	Inside Front Cover
Schieren & Co., Chas. A.	—
Schnicke, H. F.	
Scotch and Irish Oxygen Co. Ltd.	3
Scott, Walter, Ltd.	4
Shannon, Ltd.	41
Shaw, Joseph	5
Simplex Steel Conduit Co., Ltd.	—
Smith, Eric, S. A.	3
Smith, Ltd., G. F.	18
Smith's Stamping Works, Ltd.	—
Smith & Sons, of Saltley, Ltd., Thomas	
Soest & Co., Ltd., L.	28
South-Eastern & Chatham Ry.	—
Southwood, Smith & Co., Ltd.	—
Spon, E. & F. N.	
Spottiswoode & Co., Ltd.	—
Stamm, W.	24
Stirk & Sons, John	14
Stone, J. B., & Co.	33
Sturtevant Engineering Co., Ltd.	27
Suddeutsche Kabelwerke, A. G.	—
Summerscales & Sons, Ltd., W.	17
Swain & Son, Ltd., John	—
Tangyes, Ltd.	—
Taylor & Challen, Ltd.	24
Temperley Transporter Co.	3
Thom, John Z.	37
Thompson & Co., Gilbert	34
Thompson, John	—
Thornycroft & Co., Ltd., John I.	—
Titan Binder Co.	36
Trading and Manufacturing Co., Ltd.	22
Treasure & Co., J. B.	—
Tubes, Ltd.	—
Turner, Atherton & Co.	39
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, Ltd.	—
United States Metallic Packing Co., Ltd.	—
Von der Heyde, J. Bennett	—
Ward & Co., H. W.	—
Ward, T. W.	5
Waygood & Co., Ltd.	3
Weaver & Co., B.	5
Weise & Monski	—
Wells & Co., A. C.	[illegible]
Wells & Co., M.	
West & Co., Ltd., H. J.	27
West Hydraulic Engineering Co.	—
West Pascagoula Creosoting Works	—
Whitman & Barnes Manufacturing Co.	—
Wild, M. B., & Co.	17
Williams & Co., J. H.	—
Winn & Co., Charles	—
"Woodite" Co.	—
Wrigley & Co., Ltd., E. G.	Inside Front Cover
Yorkshire Patent Steam Wagon Co.	33
Yorkshire Machine Tool and Engineering Works	Inside Back Cover
Yost Typewriter Co., Ltd.	—
Zeitz & Co.	4

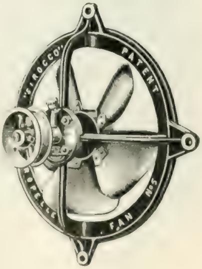
"SIROCCO" PROPELLER TYPE FANS

ELECTRIC or BELT-DRIVEN.

Greater Volumetric Capacity and Higher Mechanical Efficiency than any other Fan designed for similar work.

HIGHEST AWARD, GRAND PRIZE,
ST. LOUIS EXPOSITION, 1904.

DAVIDSON & CO., Ltd., "Sirocco" Engineering Works, BELFAST.



BRANCHES:—

13, Victoria Street, Westminster.
LONDON.

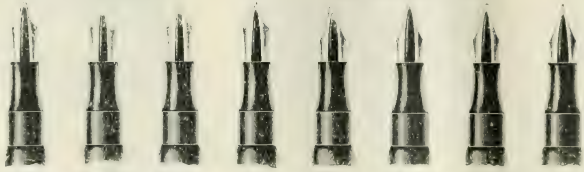
37, Corporation Street,
MANCHESTER.

115, Hope Street,
GLASGOW.

Sole Representatives for the Continent of Europe:
WHITE, CHILD, & BENEY, Ltd., 62 and 63, Queen Victoria Street, LONDON, E.C.

Some "Swan" Points. WHICH WOULD SUIT YOU?

For a Bold Hand - - - use a Broad Point, say a "J" Swan.
For an Easy Running Hand - ,, Turned-up "Swan."
For Book-keeping - - - ,, Short Medium Point "Swan."
For Shorthand - - - - ,, Long Fine Point "Swan."



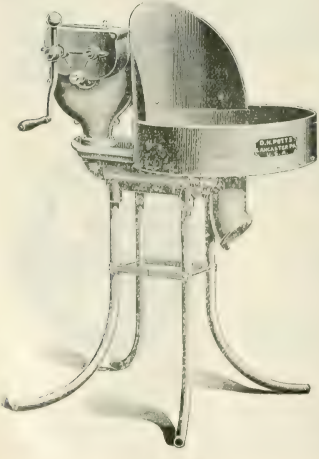
Broad. Med. Brd. Medium. Fine. Broad. Med. Brd. Medium. Fine.

EVERY STEEL NIB CAN BE SUCCESSFULY MATCHED IN A "SWAN" FOR EVERY HAND AND EVERY WORK.

Prices from 10s. 6d., 16s. 6d., 25s., up to £20, post free.

Of all Stationers and Jewellers. *Write for New Catalogue, post free.*

MABIE, TODD, & BARD, 79 & 80, High Holborn, W.C., 93, Cheapside, E.C., 95a, Regent St., W., London;
3, Exchange Street, Manchester; and Brentano's, 37, Ave. de l'Opera, Paris.


D.H. POTTS
LANCASTER PA.
U.S.A.

FAIRBANKS-POTTS

No. 27 CYCLONE FORGE.

Made with anti-ball-bearings only.

The above Forge will do a remarkable amount of work in the shortest possible time. The gearing in the fan case is cut spiral and is always in mesh, thus avoiding all possibility of ever making any noise, no matter how long it has been used. It is especially adapted for jewellers, bicycle repairers, tool tempering, repairs on boilers, rivet heating, and upon steam and electric railways. It can be easily taken apart for shipment and can be boxed in a very small space.

Write for Catalogue No. 221.

THE FAIRBANKS COMPANY,

78-80, City Road, LONDON, E.C.

Glasgow Office - - - - 9, HOWARD STREET.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

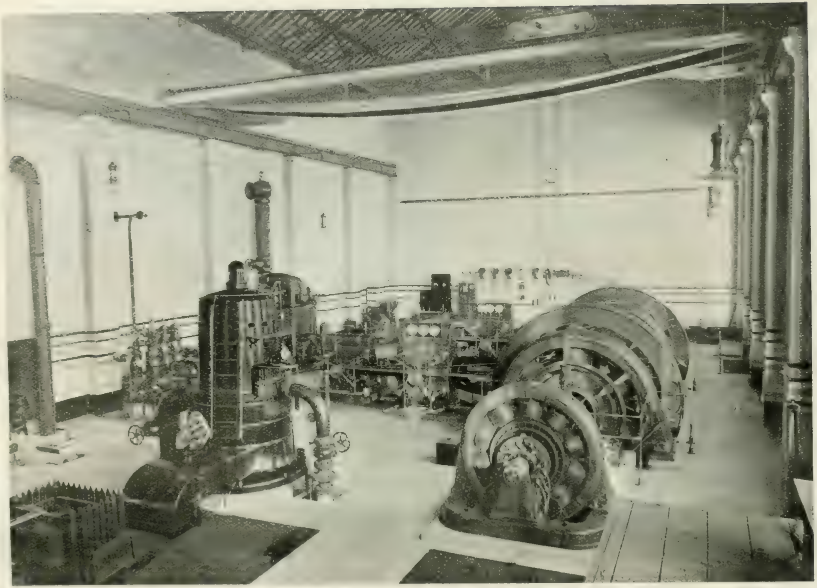
VOL. VI. LONDON, FRIDAY, MARCH 3, 1905. No. 25.

The Offices of "Page's Weekly," Wednesday, Midnight.

A REPORT on the Uganda Railway recently presented to Parliament makes interesting reading in conjunction with the article on that enterprise which appears elsewhere in this issue. It covers the construction and working of the railway and steamboat service on Lake Victoria during 1903–1904; and is of a very encouraging nature. During the first half of the year under review, the railway was under the control of the committee appointed to supervise its construction, but on October 1st, 1903, it was made over to the Protectorate, placed in charge of a manager specially selected by the Secretary of State, and became an integral part of the East African Administration. The report shows that the whole of the line, with the exception of a short length round the tunnel (mile 526) is now on the permanent formation. Embankments which had settled down owing to rain, and cuttings not previously of full width have been brought to the standard section. Owing to the repatriation of trained Indian labourers and to the employment in their places of Africans, progress with the tunnel was much slower than had been anticipated, but the difficult portion of the work was completed by the end of the year under review, and the tunnel was opened for public traffic on September 21st. This is complete with the exception of the replacement of timber by masonry abutments in the case of a few small girder openings.

All portions of the line urgently needing ballast have been attended to and at least partially ballasted. It will, however, take a

THE UGANDA RAILWAY.
Entrance to the tunnel at mile 526



RECENT TURBINE INSTALLATIONS (III.)—A CURTIS TURBO-GENERATOR ERECTED IN THE POWER HOUSE OF THE BRITISH THOMSON-HOUSTON COMPANY, LTD., AT RUGBY.

The capacity of this unit is 500 k.w., the speed being 800 r.p.m., and voltage 2,300. It is interesting to note that the capacity of the small turbo-generator is equal to the combined capacity of the reciprocating sets, which are also shown in the above view. The reciprocating sets consist of two 200 k.w. generators driven by Cole, Marchant and Morley engines, operating at 120 r.p.m., and one 100 k.w. generator driven by a Browett and Lindley engine, operating at 235 r.p.m. The normal steam pressure of the various units is 150 lb. per square inch. The British Thomson-Houston Company are the sole manufacturers of the Curtis Turbine in this country.

considerable time to bring the ballast over the whole line up to full section, but this is being done as local labour becomes available. A considerable number of wooden sleepers laid in the first section, under the supposition that salt in the soil would destroy metal ones, have become useless owing to dry rot, and are being replaced by steel, which is now found to be suitable. Experiments with local timber are being made to test its value for sleepers. Goods sheds have been erected at stations needing this accommodation, and all locomotives, carriages, and wagons used in construction work are being thoroughly overhauled and put in good working order. The following table shows the number of labourers of all kinds employed on the construction of the railway at the end of the year under review :—

Locally engaged (Africans)	3,606
Indentured Indian artisans	210
Indentured Indian coolies	521
Total ..	4,397

The health returns are about normal for the climate.

From the report on the North Sea outrage it is apparent that wireless telegraphy in war, unless handled with discretion, may be more potent as a destructive agent than submarine mines. "Attacked on all sides by torpedo boats" was the unfounded message sent on by the captain of the unfortunate *Kamchatka* to his already scared chief. After this, only a fisherman's rocket was needed to cause what practically amounted to a panic. There have since been panics at home. Only a few days ago when the garbled report of the Commission's findings was wired over we actually saw in one London daily paper the legend, "Death-blow to Arbitration!" As regards the North Sea outrage, at any rate, arbitration has been conspicuously successful.

We call attention, in another column, to a notable development in power production. A useful survey of the various gas producers which claim consideration for power purposes has just been completed by Mr. W. H. Tookey. The work, which is published by Messrs. Percival Marshall and Co., does not profess to deal to any extent with technicalities, but it is a valuable work to have on hand if only for the sake of its numerous line drawings, its plain talks affecting coal-bills, and its hints for attendants. The author remarks that in moderate-sized gas producers, even from 20 h.p., enough gas can easily be obtained from 1 lb. of anthracite coal, in every-day work, to develop 1 i.h.p. in a gas-engine cylinder under full load conditions. This shows a saving of 33⅓ per cent. In the majority of factories the actual saving is more than 50 per cent. As a practical example, he quotes the experience of a Suffolk firm of brewers, who have installed a gas-producing plant to serve a 10 b.h.p. gas engine. The engine is at work for about eight hours each day, during which time the load is constantly varying with the number of machines that are thrown in and out of work, as is common to all factories. They tell the firm of engineers responsible for the installation, that only 56 lb. of anthracite has to be fed into the generator during the whole of the day. They buy their fuel for 20s. per ton, and therefore run the whole of their machinery for 6d. per day.

Another example is cited in connection with a London plant. A firm of engineers have installed a gas (suction) producer to serve a gas-engine of 18 b.h.p. They find that the weekly coal bill amounts to 6s. per week. (They formerly paid 25s. per week for town gas for the same load.) Other practical examples cited are the electric generating stations at Walthamstow, London, and Norwich. According to the electrical engineer's report for the twelve months ending March 31st, 1904, the Walthamstow station generated a total of 651,776 Board of Trade units at an average fuel consumption of 2 lb. per unit generated. After taking into consideration the cost of fuel, oil, waste, wages for generation, repairs and maintenance of gas plant, engines and electrical plant, the works' cost per unit generated amounted to 0·89d.

At Northwich, Mond producers are used, or rather Mond gas is purchaseed from an adjoining factory at the rate of 2d. per 1,000 cubic feet. The station during the year 1901–2 sold 88,777 units, and the fuel cost was 0·47d. per unit sold. From a table published in the Electrical Times, December 4th, 1902, it would appear that the fuel costs, striking an average from the results published by 167 public electric light stations using steam power, was 0·952d. per unit sold, varying from 3·65d. to 0·71d. The question of stand-by losses should be taken into account when comparing gas engines and producers with steam engines and boilers.

The tendency towards specialisation in all lines of manufacture involves another and no less important risk to the worker, and is coincident with the decline of the all-round skilled mechanic. "Young men who enter American shops to-day," says Mr. Outerbridge, in the paper we quoted last week, "find employment in tending special machines, and soon become highly trained in their operation, so that they earn large wages, consequent, of course, upon their ability to turn out, by the aid of these machines, the maximum amount of work with a minimum of defects. They are encouraged by their employers to continue at one job, and feel little ambition to change to another class of work, or to another kind of machine, where their experience avails but little. Thus we have skilled planer hands who know nothing about the operation of lathes, milling machines, or other mechanical appliances in the same shops. The Baldwin Locomotive Works, the largest of the kind in the world, and the most highly developed in specialisation of manufacture, have already experienced the difficulty of finding young men competent to take the place of older hands, and have shown wise forethought in establishing a new school of apprentices, with a general superintendent in charge, and a staff of supervisors or foremen of apprentices."

According to the official itinerary for the South African British Association, which has been provisionally fixed, the party will leave Southampton on Saturday, July 29th. The association will assemble at Capetown on August 15th, when Professor G. H. Darwin, the president elect, will deliver his address.

THE S.S. "PORT MARIA."

The first vessel to leave London for Bermuda, Turks' Island, and Jamaica in connection with the new line of the Imperial Direct West Indies Mail Service Company, Ltd. The inauguration of the new service was recently celebrated at a dinner in London given by Sir Alfred Jones.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.
Telephone No. 3349 GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Editorial.—*All communications intended for publication should be written on one side of the paper only, and addressed to "The Editor."*

Any contributions offered, as likely to interest either home or foreign readers, dealing with the industries covered by the Weekly, should be accompanied by stamped and addressed envelope for the return of the MSS. if rejected. When payment is desired this fact should be stated, and the full name and address of the writer should appear on the MSS.

The copyright of any article appearing is vested in the proprietors of PAGE'S WEEKLY *in the absence of any written agreement to the contrary.*

Correspondence *is invited from any person upon subjects of interest to the engineering community. In all cases this must be accompanied by full name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

The Editor does not hold himself responsible for the opinions expressed by individual contributors, nor does he necessarily identify himself with their views.

Subscription Rates per Year.

Post free to any part of the world—In advance, 20s. for twelve months.

Sample Copies: United Kingdom, 6d., post free; Abroad, 8½d. post free.

Remittances should be made payable to PAGE'S WEEKLY and may be forwarded by Cheque, Money Order, Draft, Post Office Order or Registered Letter. Cheques should be crossed "LONDON & COUNTY BANK, Covent Garden Branch." P.O.s and P.O.O.s to be made payable at East Strand Post Office, London, W.C. When change of address is notified, both the new and old addresses should be given. All orders must be accompanied by remittance and no subscription will be continued after expiration unless by special arrangement. Subscribers are requested to give information of any irregularity in receiving the Weekly.

When Foreign Subscriptions are sent by Post Office Order, advice should be sent to the Publisher.

Foreign and Colonial Subscribers receiving incomplete copies through newsagents, are requested to communicate the fact to the Publisher, together with the agent's name and address.

New Copy for Advertisements,

Advertisements, &c., intended for insertion in the current week's issue should be delivered **not later than 4 p.m. on Monday.** [illegible] are requested the copy and blocks should [illegible] earlier.

The whole of the contents of this journal are copyright, and full rights are reserved.

NEWS ITEMS.

The first motor steam fire-engine built to the order of the L.C.C. by Messrs. Merryweather, has just been put into service. It delivers 500 gallons per minute.

Details of the Royal Society Show at Park Royal commencing on June 27th, are now obtainable from the secretary, at 13, Hanover Square, W.

Professor J. O. Arnold, of the Metallurgical Department, Sheffield University College, has been awarded the Bessemer gold medal of the Iron and Steel Institute. The honour was conferred by the council at its meeting on the 22nd ult.

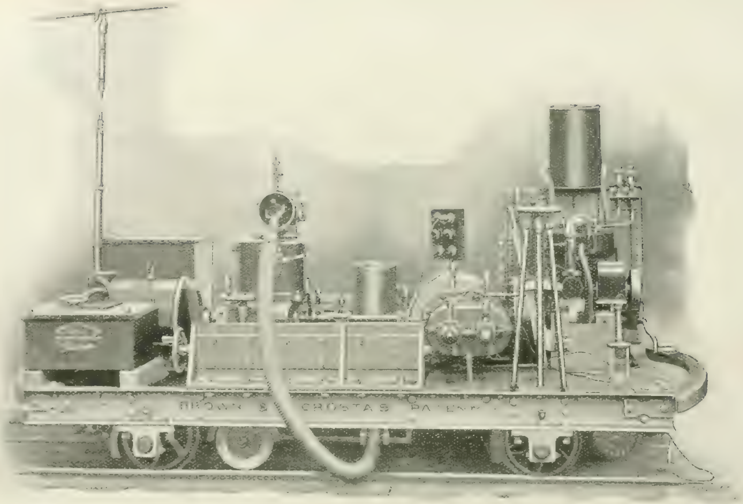
The King has been pleased to appoint the Hon. Alfred Erskine Gathorne-Hardy to be a Commissioner under "The Railway and Canal Traffic Act, 1888," in the room of Viscount Cobham, resigned. Mr. Gathorne-Hardy will also act as chairman of the Light Railways Commission.

At the opening of the 45th annual meeting of the Association of Chambers of Commerce, on Tuesday, the president, Sir William Holland, M.P., was able to refer to trade conditions of a distinctly more favourable nature, on the whole, than have obtained for a long time past.

With regard to the question of the establishment of a Ministry of Commerce, he said that the matter having been named in the King's Speech, the Government were now bound to take action in regard to it. The president thought the Association would agree that if the establishment of a Ministry of Commerce meant nothing but a change of name they could anticipate no real gain.

The Commercial Committee of Members of Parliament had met and had appointed a sub-committee to provide suggestions. He did not know what policy they would adopt, but he personally favoured the formation of a Ministry of Commerce as well as the appointment of a Minister, and he would make the Commercial Intelligence Committee a subsection of the Ministry of Commerce.

At the meeting it was decided to recommend that the improvement and extension of the canal system of the United Kingdom should be carried out by means of a public trust and, if necessary, in combination with local or district public trusts, aided by a Government guarantee, and that the executive council be requested to take all reasonable measures to secure early legislation upon the subject.



TRAMWAY RAIL GRINDER SUPPLIED TO HALIFAX CORPORATION BY THE RAILWAY AND GENERAL ENGINEERING COMPANY, LTD., NOTTINGHAM.

This machine is the joint invention of Mr. Arthur Brown, the City Engineer of Nottingham, and Mr. L. W. Crosta, the managing director of the above company. As the joints become worn with the constant striking and hammering of the wheels, corrugations are formed near the joint, causing the cars to jerk at these points. The worn ends of the rails are wedged up, welded together by the patent Thermit process, and the upper surface then ground flush with the rest of the rail. On curves the grinder has been adapted to grind away the worn-out rail in such a way that the guard rail may be fitted to it, and yet remain flush with the surface of the track.

The grinder is fitted with an electric motor so that it can travel and work from the overhead wire. It is also fitted with a 12-h.p. petrol motor, and can travel and grind from this, if the overhead equipment is cut off, or in case of construction where the equipment has not been completed. There is a complete set of drilling apparatus for drilling longitudinally and vertically, or at any angle. The grinder was referred to in a paper recently read before the Leeds Section of the Institution of Electrical Engineers, reported in the last issue of Page's Weekly. The author appears to have, inadvertently, given another firm the credit of building the machine.

NAVAL NOTES.

WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.)

GREAT BRITAIN.

THE Navy Estimates have just been presented to the House of Commons, and will be published before these notes appear. Speculation upon their provisions is therefore unnecessary, but it may be advisable to point out that last year's programme has undergone some little modification, of which note must be taken in considering the new proposals. The two battleships of the *Lord Nelson* class have been given out to contract and work on them is proceeding steadily. Three of the four armoured cruisers asked for by Lord Selborne have been commenced, the *Defence* having been laid down only last week at Pembroke. The fourth vessel, the *[illegible]*, is apparently not to be proceeded with, and the projected construction of fourteen torpedo-boat destroyers has been also abandoned. Of the fourteen destroyers of the previous programme only the *Gurkha*, the *Ness* and the *Swale* remain to be launched. The *[illegible]* took the water at Elswick on February 21st.

FRANCE.

It is now as certain as anything well can be that the French Government are about to embark upon the construction of a large number of vessels, and the programme is to cover twelve years, with an annual expenditure of some £4,[illegible] for construction. The ex-Minister of Marine had been very severely taken to task in the discussions in the Chamber, and Admiral Bienaimé in particular directed a very strong attack upon naval administration under M. Pelletan. M. Thomson, his successor, appears to have the confidence of the Cabinet, and the Chamber has heartily supported his proposal for the new building programme. Work on the *Edgar Quinet*, at Brest, has been suspended, it being M. Thomson's desire to build homogeneous vessels and not isolated specimens of different naval architects' ideas.

RUSSIA.

The Russian Naval Budget for [illegible] totals 116,[illegible] roubles ([illegible]), of which [illegible] roubles ([illegible]) is to be devoted to new construction. The majority of the new vessels are to be put in hand and be built in Russian yards, but negotiations have been proceeding with the Bethlehem Steel Company of the United States with a view to placing with them ten vessels, either battleships or armoured cruisers. It may be remembered that the *Retvizan* was an American-built ship.

UNITED STATES

In the struggle between the President and the Senate there is a danger that the American naval programme may suffer. Although the House of Representatives has passed the Appropriation Bill authorising the expenditure of [illegible] ([illegible]), and the construction of two battleships, it seems quite possible that the Senate may refuse to endorse the Bill, and at least one battleship is expected to be cut out together with some smaller items. At the present moment there are thirteen battleships, ten armoured cruisers, five protected cruisers, two gunboats and five destroyers under construction for the United States. The aggregate contract price for the hulls and machinery of these vessels is some [illegible] dollars, and the contract dates of completion extend from the present up to February, [illegible]. The completion of the torpedo craft has been very seriously delayed, and most of these should have been in commission [illegible] years ago.

JAPAN.

In the Japanese programme referred to in my notes of February [illegible], it is now reported that the number of [illegible] to be put in hand is [illegible]. Of these [illegible] will be built in government yards and [illegible] by private contractors.

Running-Shed Notes.

V.—By J. C. R. Adams.

(Continued from page 427.)

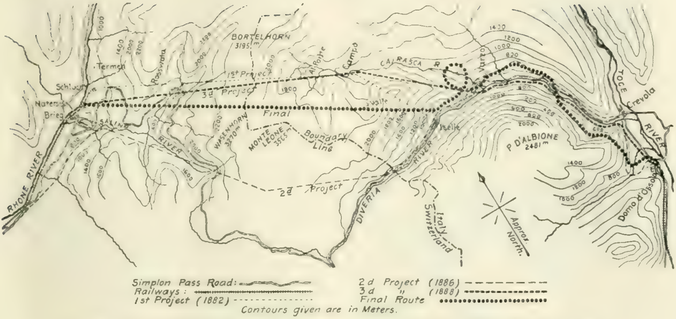
THE governor itself will also need a little attention. Without going into theory, I will deal with the question from the point of view of the engine runner, the man who has to adjust the governor so that it is stable without being sluggish, and sensitive without being unsteady.

In any spring-loaded centrifugal governor, whether its function be to control the movement of the expansion-valve, or simply to regulate the amount the throttle-valve is open, the first essential is that when the balls are out to their fullest extent, no steam shall be admitted to the cylinder, or at any rate none sufficient to move the engine round. That being made sure of, we next have to adjust the strength of the spring (usually in compression) by which the centrifugal force of the balls is more or less balanced. Now there is a particular degree of compression in a governor spring which may be termed the critical period of the governor under consideration ; and it is in practice usually found by trial by experimentally compressing the spring to the point at which its rate of increase will just keep pace with the increasing power of the balls to compress it ; a suitable spring adapted to the circumstances, as determined by calculation and previous experience, being of course assumed.

At this critical point the governor will "hunt," as it is called—the centrifugal force being balanced at all points, a difference of one revolution, or less, in the engine, will cause the balls to fly in or out to the limits of their range : a most unhappy state of things for the engine, which embarks upon a series of short runs, as if possessed by a fiend.

By cautiously reducing the pressure upon the spring through the means provided for its adjustment, we gradually [illegible] a point of extreme fineness of governing—unless this is prevented by friction or "sticking" of the governor at some point. Unless every joint in the details which partake of the movement of the governor sleeve be perfectly free, the governor will "hang" at some point in its movement, until the engine's speed is increased or reduced sufficiently to overcome the resistance. This is easily distinguishable from true "hunting," though at first sight the effect upon the engine is very much the same. Supposing all frictional resistance of this kind to be eliminated, it should be possible, upon throwing off the load, for the governor to settle down, after a few gentle oscillations, to a speed only one or two per cent. above the normal. This, however, is largely a matter of flywheel. If the energy in the flywheel is insufficient to absorb the fluctuation in the turning effort at the crank-pin, within, say, two per cent., it is manifestly waste of time to try and control the speed in revolutions per minute within this amount unless we desire to see every stroke of the engine represented by a movement of the governor sleeve. The contrivance known as a dashpot—consisting of a small cylinder filled with oil, and having a slightly leaky piston, past which the oil must squeeze its way—is sometimes used to correct a deficiency in flywheel power. This has a damping effect upon a too lively governor, but it is in no sense a substitute for a flywheel of proper weight.

It will be remembered that we began our adjustment by making the governor "hunt" ; that we reduced the pressure upon the spring, giving (in the absence of detrimental friction) an almost exactly-poised but steady governor. If now we continue to reduce the spring-pressure we lose in sensitiveness, but gain stability. The governor will not be affected by small changes in the speed, but, on the other hand, when it responds to a change of speed sufficient to influence it at all, it will move to the required point without those preliminary oscillations which before characterised its movement. These relaxations of the spring pressure, besides reducing the sensitiveness of the governor, have the effect also of reducing the rate of revolution of the engine ; and should this have fallen below the required speed of rotation, either a new and slightly stronger spring must be put in, or the ratio of the belt-pulleys in the governor drive will have to be altered to suit.



MAP SHOWING ROUTES PROPOSED FOR THE SIMPLON TUNNEL FROM 1882 AND 1893.

THE PIERCING OF THE SIMPLON TUNNEL.

THE piercing of the Simplon Tunnel last week is the culmination of one of the most striking engineering feats of the present day; it is a remarkable instance of the triumph of mind over matter. As we go to press we hear with much regret of the death of one of the engineers—Signor Grassi—through an accident attributed to an escape of gas and the high temperature which prevailed during an inspection which followed the piercing of the tunnel. Several persons appear to have been overcome, and the condition of the engineer, Signor Bianco, was also reported to be very serious. Apart from this very regrettable incident the long anticipated juncture of the north and south sections of tunnel appears to have admirably fulfilled the calculations of the engineers. Napoleon's road over the Simplon was commenced in 1800 and finished in 1806. It still offers the route for those who are in search of scenery, and whose time is unlimited. The new tunnel pierces the Alps at a lower elevation than any other route, viz., at 2,300 ft. above sea level.

Since the middle of the last century proposals have been made to tunnel the Simplon at various elevations, but it was not until 1893 that the Jura Simplon Railway Company entered into a contract with Messrs. Brandt, Brandau and Co., of Winterthur, Switzerland, to construct a tunnel from Brieg on the Swiss side to Iselle, on the Italian side of the Pass on the final route shown in the above map. The amount of preliminary work was necessarily enormous as regards both engineering and international considerations, and by an arrangement with the Swiss and Italian Governments the plans were submitted to an international commission of tunnel experts composed of Mr. Francis Fox, M.Inst.C.E. (of Westminster), Signor G. Colombo (of Milan) and Herr C. V. Wagner (of Vienna), who finally approved the present scheme. Among those prominently connected with the execution of the work have been Herr von Kager, Herr Edw. Sulzer (of Winterthur), Herr Brandau, Herr Nocher (of Zurich), Herr Pressel, etc. A treaty of authorisation for the construction was entered into between Switzerland and Italy in July 1894.

With the exception of a short curve at each extremity the route follows a straight line. It is a double tunnel with two parallel sections 55 ft. from centre to centre, each designed to carry a single line of rails. As yet only one of these has been constructed completely. The other consisting at present of a gallery some [illegible] ft. high by [illegible] ft., will be used for ventilation and purposes of construction. According to the international agreement between the two countries it need not be completed as a second tunnel until the gross receipts from traffic between the tunnel termini exceed £3,215 per mile per annum.

The exact length of the Simplon tunnel is 19,731 kilometres (12¼ miles); it is therefore by several miles the longest tunnel in the world. The mountain towers above it over [illegible] ft. on the average and [illegible] ft. at the highest point. Cross-headings connect the two tunnels at intervals of 656 ft. The extreme height of the tunnel is 18 ft. above rail-level, its width varying from 14 ft. 9 in. at the latter point to 16 ft. 4 in. at a height of 6 ft. 6 in. above rails. The centre of the tunnel is for a distance of 1,316 ft. of wider section in order to admit of trains passing. From this mid-distance there is a gradual slope to both termini, that on the north side having a ruling gradient of 2 per 1,000, while that on the south side has a ruling gradient of 7 per 1,000. The contract price for the tunnel is over £2,350,000, but, of course, the actual cost is as yet an unknown quantity.

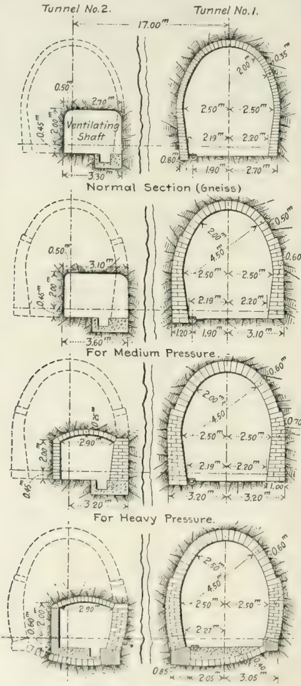


FIG. 1. STANDARD SECTIONS OF SIMPLON TUNNEL IN DIFFERENT KINDS OF MATERIAL.

The execution of this remarkable work has called for admiration all along the line, whether one considers the mechanical perfection to which the contractors brought their machinery, or the organisation of the 3,000 men employed, who appear to have worked with an undivided enthusiasm, and an almost military precision. It says something for the brains employed upon the scheme that, in spite of the most trying conditions, an excellent standard of health has been maintained among the workers, the most careful arrangements having been made to protect them from the dangers attaching to sudden changes of temperature and wet clothes. Most careful attention has also been given to vital questions of ventilation and commissariat.

An important factor in the rapid execution of the work has been the Brandt rotary drill, shown in fig. 4. According to the Engineering News, to which we are indebted for the accompanying illustrations the feed of the rotary cutting tool is accomplished by the direct pressure of water in a large cylinder, the piston of which returns automatically when the water supply is cut off. The mandril carrying the boring bar and also the cutter are driven by means of two cylinders located above the feed cylinder. These cylinders operate a shaft having a worm gear which meshes with a worm wheel centred on the mandril. The cylinders are 1⅞ in. in diameter, and their pistons have a stroke of 2⅜ in. They are operated by hydraulic pressure, and each uses normally one litre of water per second. The two cylinders are connected by cross waterways, and the piston of one acts as the valve of the other. The speed of the cutter necessarily varies for different densities of rock, but its highest speed is 10 revolutions per minute. The drill, as described, is mounted in groups of two or more on a heavy iron thrust bar about 12 in. in diameter.

In the process of excavation followed it has been usual to make an advance heading, 7 ft. 10 in. by 10 ft. 8 in., by means of the power drills. This has then been timbered and covered in for the passage of compressed air locos. and trucks. From this a shaft was driven to the roof line every 164 ft., and from these the tunnel has been opened out both ways to the complete section. Dynamite and blasting gelatine have been the explosives used at the Italian and Swiss ends respectively, and as a rule, eight blast holes were drilled at the face, the machinery and men being withdrawn for refuge to the cross galleries or service tunnel. In 1898 1,342 ft. were bored, each of the successive years up to and including 1903 being responsible for over 11,000 ft., while in 1904 5,457 ft. were excavated and during the present year 557 ft. have been taken out. The work, of course, proceeded simultaneously from both ends, but in May last driving at the Brigue end was stopped by hot springs.

An engineer connected with the work deals in the Times with some of the difficulties encountered: The gradient ascends from each entrance towards the middle of the Alps for drainage purposes, and it is due to this that it has been possible to carry on the work, as the yield of the great springs flows away by gravitation. At 4,400 metres from the Italian entrance a very large spring of cold water of 12,500 gallons per minute—in fact, a river—was struck, and this caused several months of delay at this end of the tunnel. The ground was very treacherous, so that it had to be heavily timbered; the stoutest and largest timbers were crushed, and steel girders had to take their place; but so great was the weight that these were twisted and distorted, and finally were only held in their place by being strengthened with concrete in cement. This enabled the driving of the gallery to proceed, but meanwhile the Brigue end had reached the top of the gradient in the middle of the tunnel, although the rock temperature had risen to 132 deg. F., fully 25 deg. more than had been expected. With a view to saving time, it was then decided to continue this and drive down the Italian gradient to meet the corresponding tunnel coming up from Iselle, although it was quite anticipated that difficulties would be met with in driving downhill. In this the contractors were not deceived, for very soon hot springs of 111 deg. F., and of considerable volume were met with. These springs are far hotter than is bearable, but the engineers adopted the comparatively simple expedient of throwing jets of cold water into the fissures and thus reducing the temperature as far as was necessary. The cold water is driven into the tunnel by centrifugal pumps through pipes surrounded by non-conducting material, so that the water is delivered as cool as possible.

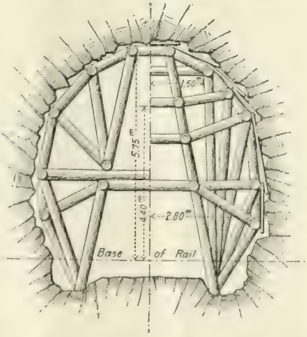


FIG. 2. STANDARD FORM OF TIMBERING FOR SIMPLON TUNNEL.

FIG. 3. EXTRA HEAVY FORM OF TIMBERING FOR THE TUNNEL.

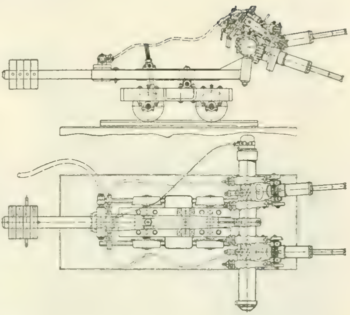


FIG. 4. ELEVATION AND PLAN OF BRANDT ROTARY DRILL MOUNTED FOR OPERATION.

At a point [illegible] metres from the northern entrance, or [illegible] metres from the top of the gradient, further hot springs were encountered of such volume that they filled the descending portion of the work with hot water and stopped driving at the Brigue end.

Meanwhile the work at the Italian face was pushed on until in September last another hot spring of [illegible] deg. F. was encountered in one of the parallel galleries amounting to about [illegible] gallons per minute, and considerable difficulty and delay were caused. By dint of extraordinary perseverance and courage these springs were passed and soon left behind by the Brandt drill. The volume of water then emitted from the tunnel was [illegible] about [illegible] gallons per minute. When the actual junction of the galleries was effected the accumulated hot water on the Swiss side found its escape into the south gallery, and was discharged into Italy.

The work that now remains to be done is to put in place the masonry arching, to cover over the water channel beneath the floor of the tunnel, and to lay the permanent way.

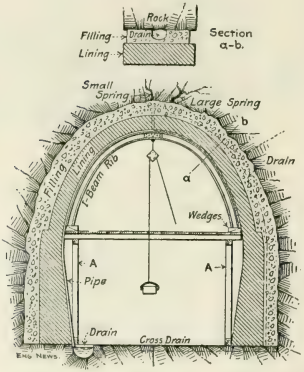


FIG. 5. DIAGRAM SHOWING METHOD OF CONSTRUCTING LINING.

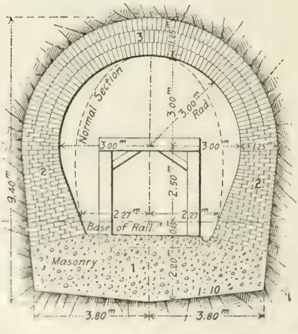


FIG. 6. LINING USED FOR VERY HEAVY PRESSURES.

TYPE-SETTING BY TELEGRAPH.

At the meeting of the Institution of Electrical Engineers on Thursday last Mr. Donald Murray read a paper on "Setting Type by Telegaph." The author said that the whole of the problems connected with the handling of types had proved very refractory, and that the complexities culminated in the printing telegraph, where the problem was to set type at a distance. The result had been that it was only within recent years that any really successful machines had emerged from the domain of experiment with the exception of the stock tickers and Hughes Printing Telegraph. Undoubtedly the best alphabet for machine telegraphy was that used in the Baudot and Murray systems. The Baudot was the one alphabet which had any prospect of coming into general use for machine telegraphy, and that being so it only remained to utilise it as the basis of a printing telegraph system. In the Murray system, selected as an example for practical illustration, the distributor was a punch-arm and a moving-paper tape, and in that form closely resembled the Wheatstone recorder, save that instead of inking the tape it punched holes in it. In the method of translating and printing after distribution of the signals the Murray system differs from all previous printing telegraphs, and belonged rather to the class of automatic type-setting machines. In this system no attempt was made to secure synchronism; it was an isochronous system, and the duplex balance was used to secure working in both directions on one wire. Retardation thus ceased to be important, and there was the further advantage that ordinary repeating stations could be used. The Murray system might be shortly described as a fully-developed Wheatstone system using the Baudot alphabet. The speed of the printer ran up to about 150 words per minute, and the automatic portion of the mechanism ran perfectly up to about 200 words per minute, but the average output was not more than 50 per cent. of the maximum. With the new motor-driven printer it was estimated that it would be possible for six operators at each end of a Murray circuit to exchange about 400 messages per hour. The system was already being used by the English and German Post Offices, and it seemed to be pre-eminently adapted for long-distance work upon wires, underground cables, and press dispatches, while there was an interesting possibility of printing telegraphy in connection with ocean cables by a combination of the Murray system with Mr. S. G. Brown's cable relayer and perforator and the Cooke alphabet. The Murray printer was originally designed for automatic type-setting by telegraph.

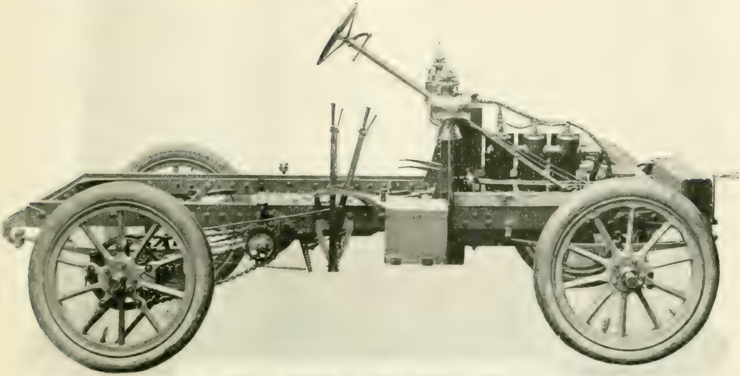


FIG. 1. CHASSIS OF NEW VAUXHALL CAR.

OLYMPIA MOTOR SHOW.

(*Continued from page* 404.)

VAUXHALL IRONWORKS COMPANY, LTD.

In the three-cylinder standard car recently introduced by this Company several new features have been embodied which call for some detailed notice. The chassis of the new car is shown in fig. 1. It is constructed of stamped steel, the longitudinal members being parallel throughout, and therefore affording direct support to the engine crank chamber and gear box. The three cylinders are separately cast and mounted on the crank chamber. The gear gives three speeds forward and reverse at the normal engine speed of 950 revolutions. A high tension ignition is employed.

A longitudinal section of the 12 h.p. Vauxhall engine is shown in fig. 2. It will be noted that the crankshaft, made in three throws, runs in four bearings, that nearest the flywheel being of considerable length. Accessibility has been brought to a high pitch, and any necessary work can be done to the crankshaft or big and little ends of connecting rods without the necessity for dismounting any cylinder. This is accomplished by the detachment of the inspection plates B1 B1 and the removal of the lower portion of the crank chamber B. The piston body is made long, and the rings set quite close to the crown giving protection from dust and oil to the combustion chamber. Another good point is the arrangement of the variable induction valve lift.

The carburetter is illustrated in fig. 4. The orifices of the tube and cap M coincide, and by the rotation of the tube the air supply can be controlled up to a certain speed, and at greater speed the automatic air valve E is brought into action, and admits more air. The radiator consisting of four tiers of seven flanged tubes is of somewhat novel design, and the type constitutes a distinct advance upon older forms.

An end view and section of the Vauxhall clutch are shown in fig. 3, which presents one or two points of interest. One is the addition as compared with former types of three leather covered spring pads, one of which is shown at F. These pads are carried on studs H, and plunge against the small coil springs set in the bosses G, and are so placed as to make for smoothness and absence of jolting when suddenly letting in the clutch. Another good feature is the abolition of the usual spiral clutch spring and its replacement by easily adjusted clutch spring bars.

A countershaft drive is employed actuating the rear road wheels through the agency of side chains. On the right hand side half of the countershaft, and placed outside the gear box, is the balance gear, the case of which forms the drum for a very wide pedal-applied band brake. Brake drums are also fitted to the road wheels, the bands being applied to these by means of the side lever.

SECTIONAL DRAWINGS OF VAUXHALL ENGINE, CLUTCH, AND CARBURETTER.

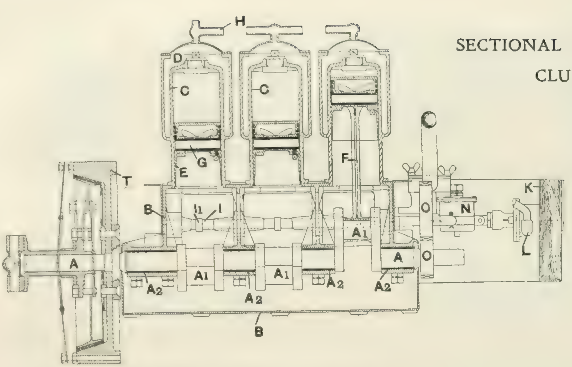


FIG 2. LONGITUDINAL SECTION OF 12-H.P. VAUXHALL ENGINE.

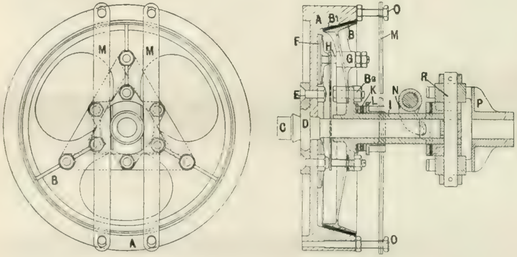


FIG. 3. END VIEW AND SECTION OF THE VAUXHALL CLUTCH

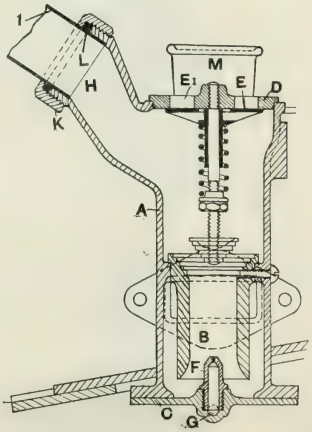


FIG. 4. SECTION OF THE VAUXHALL AUTOMATIC CARBURETTER.

A, body of carburetter
B, jet chamber
C, lower cover plate carrying petrol jet
D, upper flange forming automatic air valve seating
E, automatic air valve
E1, air ports
F, jet
G, petrol feed
H, gas passage to engine
I, induction pipe
K, union nut
L, washer
M, main air adjusting cap

WOLSELEY TOOL AND MOTOR-CAR COMPANY.

This Company was well represented at Olympia with three stands. The main features of the Wolseley cars have not been altered, but some improvements in details are to be noted tending towards simplification and easier control. The section models on the car stand showing, among other things, the working of an internal combustion engine, naturally attracted a good deal of attention, and it was a well-devised scheme for the enlightenment of the technically uninstructed.

In the Marine section the company showed a crank shaft for a 220-h.p. six-cylinder engine, a 24-h.p. four-cylinder marine engine and one of 50-h.p. This latter created something like a sensation when exhibited in the Grand Palais, and it affords an admirable example of the strides recently made by the British marine motor industry.

Fig. 5 shows the Wolseley 60-h.p. four-cylinder vertical petrol engine. The motor is of the enclosed vertical type, developing 60 h.p. at a speed of 600 revolutions.

The four induction valve boxes are held in place by two bridges, and by the removal of two nuts a bridge can be removed with its levers intact, and the induction valve boxes lifted out, leaving all the valves of two

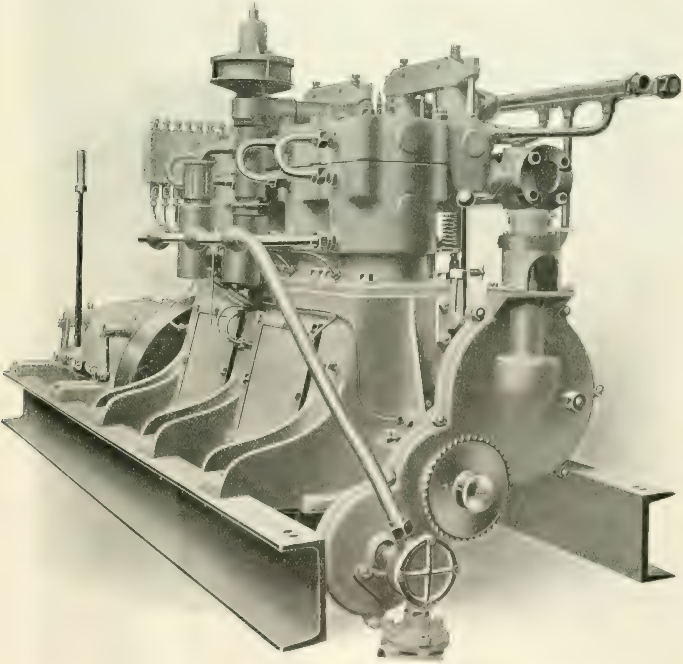


FIG. 5. 60-H.P. WOLSELEY LAUNCH MOTOR.

cylinders free. It will be seen by this means the valves are rendered very accessible. The camshaft is made in one piece, with all its cams solid with it, and is enclosed in an extension of the crank chamber. Half compression cams are fitted, which can be brought into action by a lever, to ease the starting of the motor. The ignition is electric high-tension by means of accumulators and induction coil with tremblers, but, if desired, high-tension magneto ignition is also fitted. The carburetter, which is mounted on the engine case, is of the float feed spray type, having one jet and float feed for the four cylinders.

The carburreter is water-jacketed, part of the warm circulating water passing through the jacket.

If desired the engine can be run on petroleum, a different carburetter being required. The petroleum vapouriser is of the Wolseley patent type, exhaust heated. In addition to the governor a hand throttle is fitted, and also an accelerator by which the governor may be entirely cut out of action when it is desired to race the engine above its governing speed. The entire motor with flywheel weighs just under 15 cwt., that is 28 lb. per developed horse-power.

ALBION MOTOR-CAR COMPANY.

The motor is of the two-cylinder vertical balanced type, having cylinders 4⅞ in. bore by 5 in. stroke, developing 16 b.h.p. The inlet valves are mechanically operated.

The motor is governed on the inlet by the Murray patent governor (fig. 6), which automatically regulates the speed, mixture, and ignition advance, and is controlled by a single lever. The centrifugal part of the governor is so designed that the sliding sleeve (*a*) begins to move along the governor shaft when the engine is running at 180 revolutions per minute, and only reaches the limits of its travel when the engine is running at 1,000 revolutions per minute; there is therefore a definite position of this sleeve for every speed of the engine within these limits, and by means of a hand lever (*b*) which is fitted below the steering wheel the driver can determine at will the speed at which the governor will close the throttle. At whatever speed the governor lever is set, it is claimed the car will maintain this steady speed up and down hill and on the level without any attention on the part of the driver. This, it is held, overcomes the objection to the ordinary methods used on cars for varying the speed of the governor.

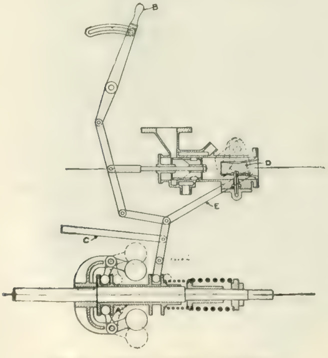


FIG. 6. MURRAY PATENT GOVERNOR.

The ignition is magneto-electric, the current being generated by the patent Albion magneto generator, which is mounted directly on the crank shaft. The armature and coils are stationary, and there are no sliding contacts, no commutators, or brushes. It is claimed to be absolutely positive in its action, and no batteries or accumulators are required.

Sir Guilford Molesworth, the president, will occupy the chair at the annual dinner of the Institution of Civil Engineers, which is to take place at the Merchant Taylors' Hall, Threadneedle Street, E.C., on the 22nd instant.

The Civil Engineering Department of the University of Leeds has sustained a loss in the death of Mr. George Wilson, D.Sc., A.M.I.C.E., Lecturer in Civil Engineering at the University.

The coal market is quiet, Cardiff correspondents reporting a quiet market for large steams, spot shipments being lower all round, although there is a better tone for forward delivery. The Newcastle market is weak, prices for current shipment showing a decline.

American correspondents report active dealings in iron and steel products. Orders for rails have been freely placed, and structural steel has been in demand. The United States Steel Corporation has again appeared in the market as a buyer. Reports from home centres are not cast in so hopeful a strain, but the shipbuilding trade remains good, and the orders for locomotive engines for Japan ought to benefit that branch of engineering. On the whole, steel makers may be said to be steadily employed.

THE UGANDA RAILWAY.

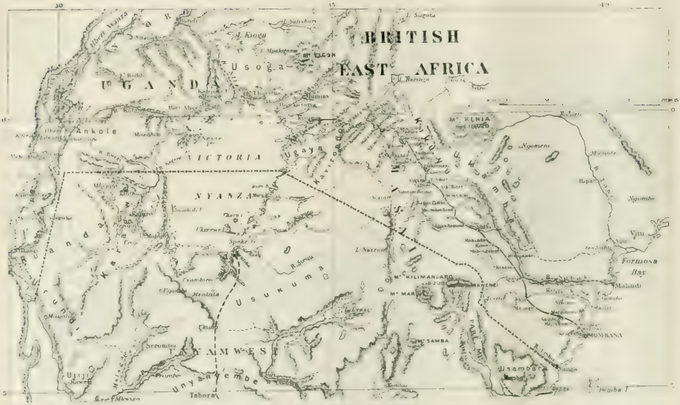
By J. D. F. Leyland.

TSAVO BRIDGE AT MILE 132.

This and the following illustrations are reproduced by permission of the Foreign Office.

OUR presence in East Africa was necessary to uphold our position there and to put a stop to the sea-borne slave-trade carried on by the Arabs, which had its source in the interior of the country. Experience had shown that coast police and a cruising squadron could not do this successfully. The conclusion, then, seemed inevitable that the only real remedy was to build a railway carrying into the country civilising influence and the means of control. It was required to open up by railway and water communication the whole coast-line of about 1,000 miles of Lake Victoria together with the adjoining fertile and populous districts. The Uganda Railway is the first to tap the Lake, and the whole trade of those districts will naturally gravitate in the course of time into this channel.

On December 17th, 1890, Sir William Mackinnon, chairman of the British East Africa Company, wrote a letter to Lord Salisbury proposing the building of a railway through British East Africa as the most effectual means of fulfilling our obligations under the Brussels Act of 1890 for the suppression of slavery. Accordingly, towards the end of 1891, a survey party, under the command of Captain (now Brigadier-General) Macdonald, was organised by the Government to examine and report upon a route for a railway to connect the seaport of Mombasa with Lake Victoria. From this preliminary reconnaissance an estimate was prepared which gave £3,400 as the average cost per mile. Sir Guilford Molesworth said he considered this far too low for such a country. From his own experience of Indian railways,



MAP OF UGANDA RAILWAY.

some of which resembled the proposed Uganda Line, the average cost of these was about £7,000 per mile. He stated that these were not subject to many of the drawbacks which affected the Uganda Route.

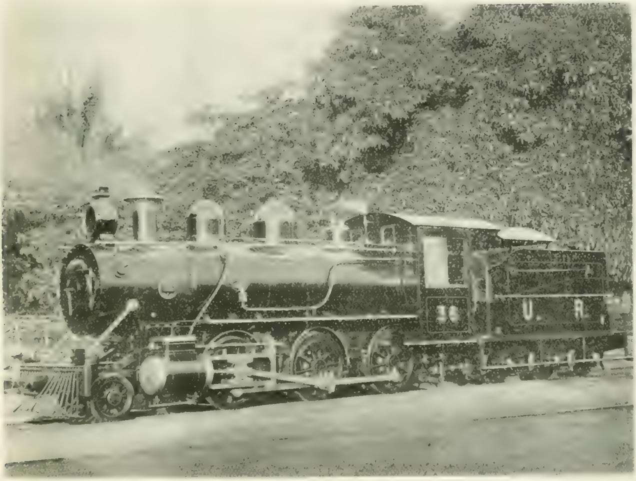
In 1895 it was determined that the railway should be constructed by Government, and, on December 11th in the same year, Mr. (now Sir George) Whitehouse, the chief engineer, and his staff arrived at the Island of Mombasa.

THE FIXTURE AND CHARACTER OF THE ROUTE.

It was originally intended that the railway should connect Mombasa with Port Victoria, on Lake Victoria, but, as the result of further surveys, it was found that the length of the railway would be reduced by 93 miles by running it to the head of Kavirondo Gulf. The station at that point has been named Port Florence.

The country traversed by the railway is, to a great extent desert, and, as a rule, waterless, sparsely populated, and without resources. Most of the Island of Mombasa was thick jungle. From the coast to the summit of the Kikuyn escarpment, about 300 miles inland, there is a general rise to the height of 7,000 ft. At this point comes a sudden descent of about 1,500 ft. into the Great Rift valley, which has an average width of about twenty-eight miles, and extends north and south considerably beyond the limits of British territory on either side. On the opposite side of the rift is the Mau escarpment, similar and parallel to the Kikuyu escarpment, but even more formidable, rising to the height of about 8,500 ft., and about 2,500 ft. above the floor of the rift. The country then falls sharply towards the level of Lake Victoria.

From the coast towards the lake the first fifteen miles is cultivated; then there is a sparsely wooded tract, about thirty miles wide, and the Taru desert, fifty miles in width, which is absolutely waterless, and covered with almost impenetrable jungle; next is another hundred and fifty miles of jungle, not quite so dense, with very little water, except the Tsavo river, about hundred and thirty miles from the coast; and then the Athi plains stretch for about fifty



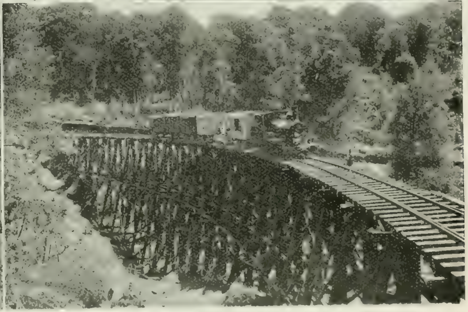
ONE OF THE AMERICAN LOCOMOTIVES IN USE ON THE UGANDA RAILWAY.

miles, which are treeless and almost waterless. Up to this point there is no shade from the sun; the jungle only serves to shut out all wind, and the water is hard and brackish. Beyond, the character of the country changes abruptly; it becomes well wooded, cultivated, and intersected by numerous streams. The slopes of the escarpments are covered with dense forest. All the Rift lakes except Lake Naivasha are salt.

Shortly after leaving the coast the line surmounts the Rabai hills, crosses the Taru desert to Voi, then follows the course of the Mtoo-wamowe valley, and across the Athi plains to Nairobi; next it crosses the Kikuyu escarpment down into the Great Rift valley and over the Mau escarpment and descends to the shores of the Victoria Nyanza. At the Kikuyu escarpment, mile 355 from the coast, the line had to climb to a height of 7,830 ft., then descend to 6,000 ft. At mile 430, and again at the Mau escarpment, mile 490, it had to climb to 8,320 ft., descending to the lake at a level of 3,720 ft. above the sea, at mile 584. Over the greater part of the last hundred miles of this route previous to September, 1898, no European had ever trodden. Commander Whitehouse in a paper read before the Society of Arts, said: "Never before has a railway been built under such extraordinary conditions or caused such radical changes in the country through which it has passed."

The railway has comparatively long stretches of easy work, but the great altitude which has to be reached, the sudden ascents and descents, the severity of the gradients, and the sharpness of the curves necessary to avoid expensive construction, give it difficulties equal to those of a mountain railway. Permanent telegraph wires on suitable iron posts follow the railway.

MOKO STATION YARD, MILE 462.
REVERSE (TEMPORARY LINE) AT MILE 485.



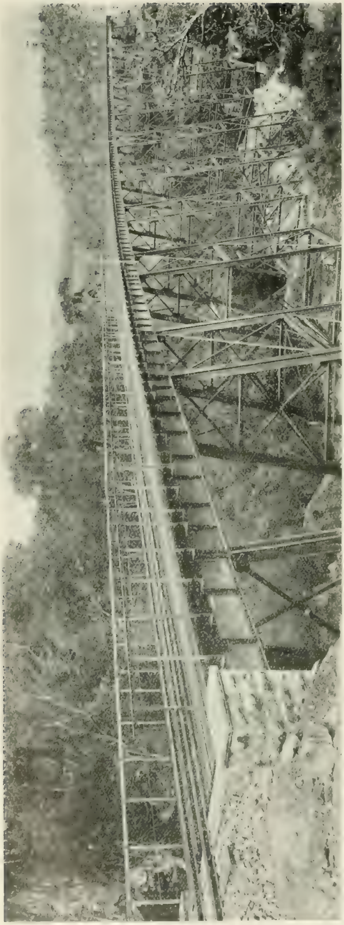
VIEW AT MILE 507.
TEMPORARY TRESTLE BRIDGE AT MILE 479.

There are thirty-two permanent stations on the line, and its total length from Mombasa to Port Florence is 586 miles. The ruling gradient is 1 in 50. The sharpest curve on the main line is of 573 ft. radius. All along the line the Chief Engineer took up an ample amount of land on either side, partly for the purposes of extensions, etc., and partly to prevent speculators buying it up at a very low price, and then putting a high price upon it. The surveys and sections for the whole line were not completed until April, 1900.

THE DIFFICULTIES AND COUNTERACTING ADVANTAGEOUS CONDITIONS.

This railway is unique in the fact that nowhere before had a railway been constructed amid such great difficulties, and in so short a space of time. Sir Guilford Molesworth, in his report of 1899, said: "Great credit is due to the Chief Engineer for the manner in which he has initiated and developed this organisation under circumstances of unparalleled difficulty." He also said, concerning the descent into the Great Rift Valley: "I consider the whole line, as staked out from Nairobi to the lowest point of the descent, a distance of forty-nine miles, both in conception and execution, a masterpiece of engineering skill, which reflects the greatest credit upon all concerned." When Mr. (now Sir George) Whitehouse first went out to Mombasa he had to construct extensive jetties, and erect cranes for the landing of railway material and stores, to lay down moorings and buoys, and to sink wells, at the port of Kilindini, which is on the opposite side of the Island of Mombasa, and had been selected by Captain Macdonald in preference to Mombasa itself. Then a line had to be constructed with a gradient of 1 in 50 from the jetties to the railway station, which is some 70 ft. or 80 ft. above the sea level. No steam launches were available, and all labour had to be imported from a distant country, namely, India, and housed on arrival. The members of the staff were new to one another, to the country, and to the conditions of working. No supplies whatever were available, and everything had to be imported. The country was in a disturbed state, and survey parties could not be sent out at first without a military escort.

The first engineering difficulty that was met with was that of crossing the arm of the sea between the island and the mainland. Captain Macdonald suggested in his scheme the building of an embankment, but this was found to be impossible, as the stream is 14 ft. deep, and has a tide running at four knots an hour. The construction of a temporary wooden bridge was immediately commenced, pending the building of the permanent one of steel, as no work could be carried out on the mainland until this was achieved. This temporary structure made a diversion of two miles necessary. Following this the Rabai hills had to be surmounted, involving some of the heaviest work on the line. To push on the rails rapidly it was necessary to put in a considerable length of temporary line. Similar temporary diversions, beginning at the Macupa bridge, mile 2, were adopted at intervals along the line. The locomotive power was insufficient at first, and it was difficult to keep railhead supplied with materials. At about mile 50, the line enters the Taru desert, which has been referred to, and the earthwork here was a mere nothing when compared with the difficulty of clearing away the jungle, which will not burn readily, and grubbing up the stumps. From mile 162, to Kibwezi, mile 193, the work was very heavy, and necessitated numerous diversions, several considerable bridges, embankments and rock cuttings. In consequence of the general character of the line and of the numerous diversions an abnormally large number of locomotives was required in order to insure satisfactory progress. At mile 362 four temporary rope inclines had to be constructed with great labour. The reason for the construction of these inclines is dealt with hereafter.



CHARACTERISTIC VIADUCT AT MILE 511.

The Uganda Railway has often erroneously been compared with the Soudan, Rhodesian, and Baluchistan Railways, in which, however, though the conditions may seem similar, they are really very different. The Soudan Railway which crosses the desert from Wady Halfa, presented no difficulties to the engineer, save the absence of water. It necessitated very few curves, and no cuttings or embankments of considerable size. That line has a 3 ft. 6 in. gauge, and powerful engines weighing forty tons each. In Europe it would rank as a first-class railway. The Rhodesian Railway, from Mafeking to Buluwayo, is one with very few curves, embankments, or cuttings and very slight gradients, while the only river it encounters is crossed by laying sandbags under the sleepers. Five hundred miles of this railway were laid in four hundred working days, which shows that there cannot have been many difficulties. The Baluchistan Railway, like the Uganda Railway, goes through a practically waterless country, but has very few curves, cuttings, embankments, or bridges, and a very small ruling gradient. It had, moreover, all the resources of India at its command. Labour was unstinted, and little was required, except to scrape the ground and lay the rails. The Congo Railway is the only one in which the work resembles the Uganda Railway, but it is of a much lighter description. The gauge is 2 ft. 3½ in., the ruling gradient 1 in 22, the minimum radius of curve 164 ft., and the greatest elevation above the sea level 2,444 ft. There was also a greater length of time allotted in which to complete it. The first 240 miles were accomplished in more than seven years, whereas the first 240 miles of the Uganda Railway were completed in two years and five months.

In addition to the engineering difficulties there were in East Africa many extraneous ones, which may be said to be peculiar to this railway, and few of which were or could have been foreseen at the outset.

To be continued.

OUR WEEKLY BIOGRAPHY.

MR. ALAN A. CAMPBELL SWINTON, M.Inst.C.E., M.I.E.E.

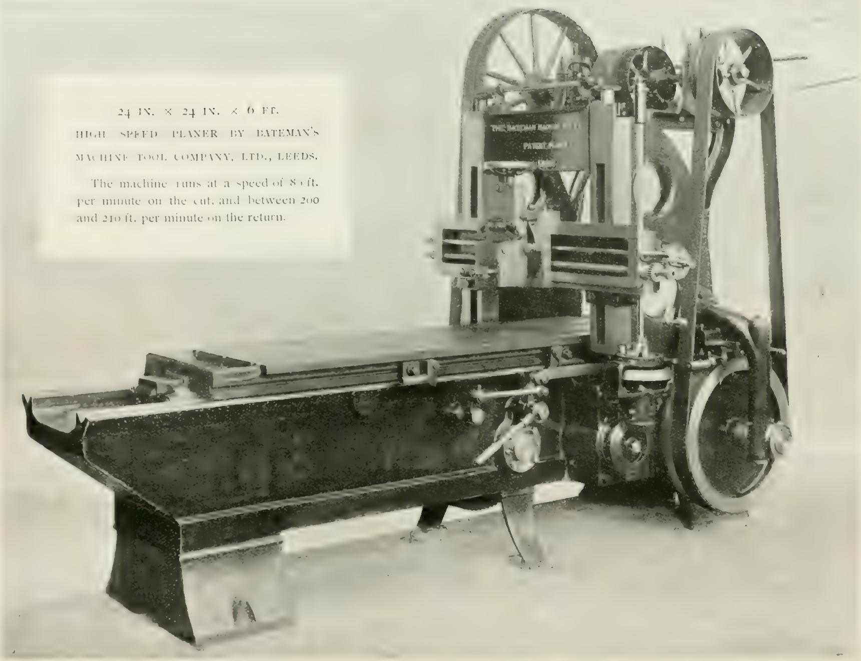
MR. ALAN A. CAMPBELL SWINTON, consulting engineer, belongs to a very distinguished family who have held lands in Berwickshire since the eleventh century. He was born in 1863, and received his education in Edinburgh and abroad. In 1882 he entered the Elswick works of Messrs. Sir W. G. Armstrong and Co. Two years later he was appointed electrical engineer to the firm, and was responsible for the lighting and other electric gear on all the war vessels built by that company until 1887, when he left Newcastle for London retaining, however, the position of electrical adviser to the Tyneside firm, a position which he continues to hold.

Since 1888 he has carried on a successful consulting engineering practice in Westminster, and has been responsible for many important works for electric lighting, power and traction, in various parts of the country and abroad. He is managing director of the Cambridge Electric Supply Company, and of the Scarborough Electric Supply Company, Joint Engineer to the Scarborough tramways, the Falkirk and District tramways, the Stroud and District tramways, and the Kent Electric Power Company. He was one of the first engineers to advocate the use of the Parsons steam turbine, and was a member of the original syndicate which built the *Turbinia*, and has been a director of the Parsons Marine Steam Turbine Company since it was formed in 1897.

MR. ALAN A. CAMPBELL SWINTON, M.INST.C.E., M.I.E.E.

Mr. Swinton has written two books on electric lighting and many articles on engineering and scientific subjects, and having devoted considerable attention to scientific research, more especially in connection with Röntgen and Cathode rays, high frequency and other electrical phenomena, he has communicated several papers on these subjects to the Royal Society, the British Association, and the Physical Society. He has also lectured at the Royal Institution, the Society of Arts, the Royal Engineers' Institute at Chatham, the Glasgow and Newcastle Philosophical Societies and other similar institutions. He read a paper on "Electricity from Water Power" at the last meeting of the British Association at Cambridge.

Mr. Swinton is a member of the council of the Institution of Electrical Engineers. His favourite recreation is motoring.



24 IN. × 24 IN. × 6 FT.

HIGH SPEED PLANER BY BATEMAN'S MACHINE TOOL COMPANY, LTD., LEEDS.

The machine runs at a speed of 80 ft. per minute on the cut, and between 200 and 210 ft. per minute on the return.

HIGH-SPEED PLANERS,

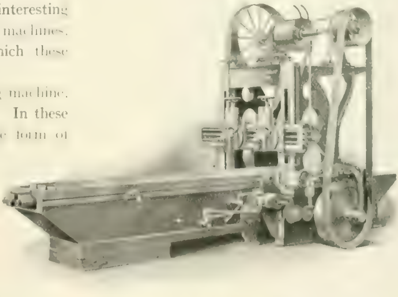
By Bateman's Machine Tool
Company, Ltd., Leeds.

THE illustration below shows the latest type of high-speed planer designed by Bateman's Machine Tool Company, Ltd., of Leeds. Considerable attention has been bestowed by this firm upon the details of these machines, with the result that very exceptional qualities have been secured, more particularly in the direction of smooth running and rapid speed. This will be understood when it is stated that the 36 in. by 36 in. by 10 ft. machine, with side stool, shown herewith works at a speed of 55 to 60 ft. per minute on the cut and 160 to 170 ft. per minute on the return, while the machine illustrated on the opposite page is claimed to be the fastest planing machine in the world. This is a 24 in. by 24 in. by 6 ft. machine, which is at present running in the shops of the firm at a speed of 80 ft. per minute on the cut and between 200 and 210 ft. per minute on the return. It will be interesting to examine the construction of these machines, and to glance at the means by which these results are obtained.

In the ordinary rack-driven planing machine, the rack is bolted direct to the table. In these planers a patent is introduced in the form of a sliding bar, to which the rack is fixed, and which has a short longitudinal motion in a groove on the underside of the table. To a cross head at one end of the sliding bar, spindles are secured carrying adjustable springs. These springs absorb all the shock of reversal, and their compression helps the table to start in the new direction at reversal, so that the belts are consequently relieved of much of the extra strain to which they are subjected in the ordinary type of planer.

The beds of these machines are heavily designed, being extra deep, and strongly barred, and in all but the small machines are of double box form without feet. They are unusually long, the run-over of table consequently being very short. The strongly webbed tables are provided with longitudinal T slots, varying in number according to the size of table, together with a series of stop holes for the convenience of setting the work quickly.

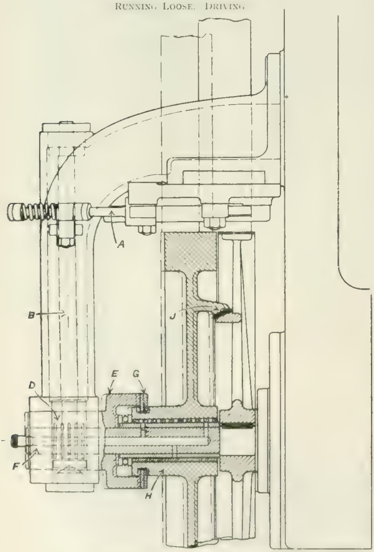
The deep cross-rail has large bearing surfaces, and, except on the small machines, can be raised and lowered by power as well as by hand. Its length provides, that, where two tool heads are used, the near head can be traversed across the



36 IN. × 36 IN. × 10 FT. PLANER

whole width between the housings quite independently of the off head. The planers, if of medium or large size, are built to carry two tool-heads on the cross-rail, and one side tool-head on the near housing, and can also be fitted with a side tool-head on the off side. The feeds for the cross-rail tool-heads are entirely automatic. They are started, changed, or stopped instantly while the machine is at work, and are actuated by a new friction arrangement through a vertical shaft carried on ball bearings. The vertical feeds on the side tool-heads are actuated by the knocking-off arrangement.

The high-speed gearing is chiefly of cast steel and is lubricated in an oil bath. The other gearing is of cast iron, the high-speed shafts being of carbon steel, and running suitably bushed in bearings.



FLYWHEEL AND FRICTION CLUTCH.

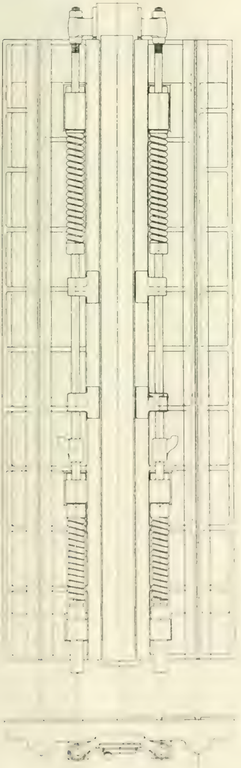
The [illegible] in action, cutting to full lines; out of action, returning [illegible] dot lines.

The standard type of planer is fitted with brackets on housings to carry either the countershaft or the countershaft and motor combined. Machines of this kind are entirely self-contained, and can be placed anywhere in a shop; the centres of the belt pulleys and the countershaft pulleys are also thus kept well proportioned, and the countershaft bearings are so designed that any stretch that takes place in the belts can be readily adjusted.

An important point is the introduction of patent fly-wheel loose pulleys for use with overlapping belt, and with automatic friction clutch between the fly-wheel and fast pulley, of which there is one on either side of the machine for cut and return.

The action of the clutch is briefly as follows: The rod A, which is actuated by the belt-shifting arrangement, moves the vertical shaft B, at the bottom of which is keyed a small pinion D, gearing into short rack cut on slide bush E, which is free to move along the pulley shaft F. Attached to the inner edge of the slide bush E are segments of gripping ring G, working in recess on the boss of flywheel loose pulley H. Between the end of the boss of flywheel pulley and the end of slide bush is a ball thrust bearing. The flywheel loose pulley H is also free to move along its shaft, and it will be seen that any motion given to rod A is transmitted into the flywheel, and either moves it so that the friction clutch J is brought into or out of action. This motion is so timed to take place when the belt is thrown on or off the fixed pulley, and, together with an overlapping of the belt from the fixed on to the flywheel pulley, enables the conserved energy of the flywheel to be transmitted into the fixed pulley at a moment when a large amount of power is required on such machines, owing to the sudden reversal of the moving parts.

It would not be possible to run the ordinary planer at such high speeds without a very excessive use of power at the moment of reversal, were it not for some such means as above described, and also if this were attempted, the effects in the other parts of the machine would be serious, as the shock and jar of the reversal would inevitably break the gearing. This trouble is overcome by fitting the cushion springs (referred to above) under the table, so that the drive is transmitted through the gearing on to the rack, which has a free slide motion along the length of the table, and transmits the motion received through cross head at the end, and through the springs on to the fixed bosses or lugs on the table.



PLAN OF UNDER SIDE OF HIGH SPEED PLANER-TABLE SHOWING ARRANGEMENT OF SPRINGS.

It will be seen, by referring to the drawing, that one set of springs acts on the reversal from cut to return, and the other set on the reversal from the return to the cut, this being accomplished by connecting up with the compression rods. The springs are adjustable, so that no more motion than is required takes place, while on the cut there is a metal to metal pressure, and the drive is not transmitted through the springs.

Electric Power Scheme for London.

Considerable interest attaches to a bill which is being introduced this Session with the comprehensive title "Administrative County of London and District Electric Supply Company." Powers are sought under the bill for the purpose of enabling a supply of current to be given to existing authorities, the latter to have the option of continuing to distribute it to light and power users. The maximum charges under the bill range from [illegible] to [illegible] per unit, and the dividend of the new company is to be on the sliding scale system adopted by gas companies, the standard rate being [illegible] per cent., with an additional [illegible] per cent. for every [illegible] per cent. reduction in the price of current. The powers sought to cover [illegible] the East End of London with its manufacturing districts and [illegible]. Should the scheme be carried out, it is stated that it would mean a considerable cheapening of the cost of electrical power in London. The latest Board of Trade returns [illegible] Lord Armstrong, Sir [illegible] M.P., Sir [illegible] the Right Hon. [illegible] M.P., Sir [illegible] Wood, Mr. [illegible], Mr. F. W[illegible] and Mr. A. J. [illegible]

SCIENCE IN THE IRON FOUNDRY.

By J. E. Stead, F.R.S., F.I.C.

(Continued from page 422.)

SAMPLING PIG IRON FOR ANALYSIS.

WHEN a consignment of pig-iron arrives at the works, before taking any sample, note should be made whether or not the metal in the trucks is apparently regular or of mixed quality. If regular, two or three pigs off each truck should be selected. If irregular a larger number. These should be broken and note taken of their fracture number. Drillings should be taken from the side, half-way between the bottom and top of the pigs. After the drill has penetrated ⅛ of an inch below the skin, what is removed in this way should be rejected, and the drill then bored to the centre, and the clean drillings reserved for analysis. The drillings from the several pigs should be mixed in equal proportion, and the mixed sample should be thoroughly cleansed with a magnet to eliminate any grains of sand which may have accidentally fallen into it.

The importance of taking drillings from the position given will be recognised when it is known that the sulphur is always much higher at the top than at the bottom of the pigs. Indeed, I have found three or four times as much in the upper layer as was present in the bottom layer. Mr. Guy Johnson, in one of his trials, found an average of 0·024 per cent. in the lower part, 0·108 per cent. in the central portion and 0·148 per cent. in the upper layer, the centre portion approximating to the average. The more manganese present in the pig the greater is the flotation of the sulphide of manganese at the top.

It will be readily conceived that in consequence of the property of the sulphur compound to float off, the metal which runs into the pig moulds should have less sulphur than the same material when it leaves the furnace. This is actually the case, and the difference is usually the greater when the amount of manganese present is larger. I have met with scum on the surface of basic pig which contained 5 per cent. sulphur.

The American Association for the standardisation of methods of testing suggest taking four pigs from every car and boring with a large drill each fractured end at a point midway between the centre and the side. This method has the advantage that there is less liability of sand getting into the sample, and there is less trouble in drilling. Both methods should give the same average sample.

THE EFFECT OF METALLOIDS CN CAST-IRON SILICON.

In 1875 I made an experiment to ascertain the effect of heating to whiteness a pure white iron, free from silicon, in a crucible lined with ganister. The result was that the white iron was turned grey. Analysis proved that some of the carbon had acted on the silica of the ganister according to the equation—$SiO_2 + 2C = Si + 2CO$, with the result that nearly 1 per cent. of silicon was found in the metal. On melting this metal with a little iron ore the silicon was removed and the metal again became white. These experiments were clear evidence that the silicon had been responsible for throwing the carbon out of combination with the iron.

In 1885, Mr. Charles Wood, one of our most esteemed Past Presidents of the Cleveland Institution of Engineers, conducted experiments in order to test a statement which I had made to the effect that if he melted together two almost unsaleable products of his blast furnaces—glazed iron and white iron—he would obtain a good soft grey iron, quite suitable for foundry castings. The result of Mr. Wood's trials were given in a paper read before the Iron and Steel Institute in 1885.

Glazed pig iron with 4·43 per cent. silicon was melted with white pig iron in varying proportions, with results which Mr. Wood considered to be rather surprising, for the castings produced were as good as could be wished for. Previous to the publication of this paper the rôle which silicon played had not been understood in England. Professor Turner had, however, three months previously shown in a paper read before the Chemical

---

Lecture before the Cleveland Institution of Engineers.

Society that the addition of ferro-silicon to pure cast iron, practically free from sulphur, or a compound of iron and carbon alone increased its tenacity.

In 1886 Mr. Fred Gautier, Paris, in a paper on "Silicon in Foundry Iron," read before the Iron and Steel Institute stated that the experiments just referred to proving that white pig iron with a suitable addition of silicon would give grey castings of the best quality opened an entirely new departure in metallurgy, the practice of the most experienced founders being based on a totally different view. He also stated that in his opinion "this discovery is perhaps even more important than that of the basic process itself, and the discussion which followed upon it did not seem to be adequate to the importance of the subject." The so-called discovery referred to was the fact that silicon acted indirectly in causing the combined carbon to assume the graphitic condition.

It was not long after the publication of Professor Turner and Mr Wood's papers that glazed pig iron, previously unmarketable, was sought after by founders, and a great demand sprang up for ferro-silicon. Although it was Mr. Charles Wood who first made trials on a commercial scale by mixing silicon pig and white pig iron with the production of a grey mixture, it must not be forgotten that Professor Akerman, of Sweden, had thirteen years previously shown the tendency of silicon and combined carbon to replace each other, and that had founders and others read his paper with intelligence they might have made advantageous use of his observations. Dr Percy, in his work on iron and steel published in 1864, page 131, says: "It has long been observed, in the first instance by Sefstrom, that the carbon in grey iron in which much silicon exists, say 2 per cent. to 3 per cent., is wholly, or nearly so, in the graphitic state. It is not, however, to be inferred that silicon has displaced the carbon," from which it would appear that Dr Percy did not thoroughly understand the rôle played by silicon.

Referring to the remarks regarding the work of Professor Turner and Mr Wood, Professor Ledebur in a paper published later and read at the Darlington meeting of the Iron and Steel Institute says: "The presence of silicon in pig iron consequently diminishes its capacity for taking up carbon, and on the other hand, it is necessary for the formation of grey pig iron. Pig iron free from silicon remains white even after slow cooling, and grey pig iron changes into white if its contents of silicon is extracted. . . . From this the deduction follows directly that if molten white pig iron has the opportunity afforded it of taking up silicon it will change into grey pig iron."

It would appear then that both Professor Akerman and Professor Ledebur have the credit of having previously published the exact rôle which silicon plays in cast-iron, but it must be remembered that neither of the gentlemen had suggested the mixing of silicon pig with white iron. Indeed Professor Turner, in his work on the metallurgy of iron (1900), page 196, says: "The practical application of silicon in the foundry is due chiefly to Mr C. Wood, Middlesbrough, who was working in this direction with Mr. Stead in 1885."

It is well known by pig iron manufacturers that grey pigs with the lowest percentage of silicon are the most difficult to break, and a fair idea of what amount of silicon is present may be formed by watching the breaking of the pigs. No. [illegible] Hematite pigs with 1.5 per cent. silicon are only broken with difficulty; with 2.5 per cent silicon, not so easily; and with 3 per cent silicon and above very easily. It will be understood then that silicon directly weakens iron and renders it less resistant to shock.

Glazed pig iron contains high silicon. The peculiar glazy appearance of the fracture is due to the cleavage faces of the metallic matrix, which are not seen in pigs containing little silicon, as the cracks of the fracture when the matrix is strong pass mostly through the cleavages of the plates or curved sheets of graphite. The cleavages of the matrix are where the flakes of graphite are close.

Silicon has a much stronger affinity for iron than carbon, a fact easily proved by melting white Swedish iron with 20 per cent. silicon in a closed graphite crucible. The whole of the carbon will be expelled and float to the surface of the metal. The white metal remaining will be [illegible] and free from carbon. I believe it was Mr. [illegible] Riley who first discovered that metal with 20 per cent. silicon contains no carbon and is quite white. From this it follows that silicon cannot be cemented by the cementation process. It is necessary to have a melting heat before carbon will pass into such iron, but at the point of solidification what is present will be thrown out of solution, and no combined carbon will remain in the solid metal.

Valuable papers on silicon and iron have recently been published by Mr Gautier and another by Mr [illegible], which should be generally studied by every metallurgist.

EFFECT OF SULPHUR.

The direct effect of sulphur on the strength of cast iron has long been regarded as injurious, and but little experimental work seems to have been carried out to determine the [illegible] of this impurity. [illegible] Mr [illegible] and Mr [illegible]. [illegible] will be seen, the evidence appears to show that provided sulphur does not keep the carbon from separating as graphite, even 0·15 per cent. has very little effect, if any, on the strength of the metal. In the experiments conducted by Mr. Wood the presence of 0·16 per cent. sulphur did not appear to be harmful.

In Mr. Johnson's trials the only direct effect appeared to be that of making a closer grain, and consequently a stronger casting. Its effect, however, indirectly is undoubted, for unless the silicon is fairly high it prevents the separation of graphite, and a hard iron is the result. It follows, therefore, that when making the strongest iron castings the silicon should be low and the sulphur very low. The good quality of cold blast iron is undoubtedly due chiefly to the association of a low silicon and sulphur content.

Chemical examination has shown that when the manganese reaches or exceeds 0·50 per cent. the sulphur exists mainly as sulphide of manganese. This separates out before the metal becomes solid, and owing to its low specific gravity, begins to float upwards, and some of it eventually escapes out of the metal, but if the surface metal solidifies in advance, the elimination of the sulphide of manganese cannot occur, and it is mechanically held in the upper layer of metal. This is the reason why pigs contain more sulphur at the top than at the bottom.

Once the sulphide of manganese has separated independently, it no longer exerts any influence on the carbon condition, even although it may be enclosed in the metal. In proof of this I possess a piece of a large grey cast-iron, broken from the upper end of an ingot mould, which contains 1 per cent. sulphur as sulphide of manganese, and yet there is no combined carbon present. The original metal contained about 0·90 per cent. manganese and 0·07 per cent. sulphur.

Mr. Andrew Blair, of Boston, U.S.A., found sulphide of titanium in very grey pig iron in the form of idiomorphic crystals, which had the following compositions:

Titanium	62·82	per cent.
Iron	1·82	„
Carbon	9·82	„
Sulphur	22·64	„
	97·10	

When little manganese is present some of the sulphur undoubtedly exists in the form of iron sulphide.

There can be no doubt that whether it exists as sulphide of iron or sulphide of manganese each substance has the physical properties of scoria, and the presence of scoria from the purely mechanical point of view cannot be regarded as beneficial.

It will be [illegible] examining the specifications of the American founders that sulphur above 0·085 per cent. is not allowed in anything excepting special hard iron such as that required for brake shoes, etc.

Whilst admitting the advisability of using irons with as low sulphur as possible for the strongest small castings, yet in larger sections and masses there can be no doubt that sulphur may be higher without great disadvantage; indeed, the best Staffordshire chilled rolls contain 0·17 per cent. sulphur.

EFFECT OF CARBON.

The combined carbon is mainly the determining factor of the hardness and shrinkage of a casting. The conclusions of Professor Howe, that the strongest iron is that in which the metallic matrix is pearlite with no massive carbide of iron, appears to me to be perfectly sound, but that excepting in the case where there is little or no phosphorus there is almost always some massive carbide present if the combined carbon reaches 0·90 per cent. for the simple reason that, as in Cleveland iron, the phosphorus unites with a considerable proportion of the iron which, separating out as a eutectic, leaves less free iron capable of existing in the eutectoid pearlite. Probably 0·70 per cent. is the highest amount admissible for such iron with good machining properties.

For general engineering foundry castings about 0·50 per cent. is a fair amount.

The total carbon should not exceed 3·25 per cent. either in soft or hard castings.

In the average irons available in this district it runs between 3·30 per cent. and 4·20 per cent., the higher figure representing that in low silicon grey hematites.

Professor Howe considers air-furnace melting preferable to cupola melting on account of some of the carbon being burnt out in the air furnace, but the same object can be gained by the judicious use of steel scrap in the cupola furnace. Bessemer steel scrap when melted alone in a very hot cupola absorbs about [illegible] per cent. carbon, but, if melted with pig iron high in carbon, little carbon passes into it. Indeed when melting 80 per cent. pig, with 3·75 per cent. carbon and 20 per cent. scrap with 0·35 per cent. carbon, the melted iron will contain about 3·25 per cent. carbon. That is to say, the steel only absorbs under such conditions about 0·75 per cent. carbon.

The quantity of steel admissible must depend upon the other elements present in the iron and on the size of the casting. To put a large dose of steel into a metal low in silicon and carbon and high in sulphur would make the iron white, but when the iron is sufficiently high in silicon and low in sulphur a large quantity of steel can be employed.

The conditions favourable for the use of steel can only be determined by the assistance of chemical analyses of the pig irons which have to be melted with it.

The reason why high carbon in the graphitic state is objectionable is on account of the fact that every plate of graphite mechanically breaks the continuity of the metallic matrix, and the fewer of such breaks within reasonable limits, the more coherent is the mass.

The great value of steel scrap has been fully proved by many founders in America, and also in some works in our own country.

EFFECT OF MANGANESE.

The manganese in English and Scotch irons is generally higher than in those of American origin. Founders in this country have always regarded Scotch brands as the very best obtainable, and these are peculiar by containing much higher manganese than allowed by American founders. In my own experience manganese strengthens the iron, and if it does not exceed [illegible] per cent. may be advantageous, indeed, it appears to effect the removal of a small quantity of sulphur or prevents that element from being retained from the coke in the cupola. The experience in America, however, proves that good castings of high quality may contain very little, and it is questionable whether, or not, a slight increase in the combined carbon will not be equivalent to a decrease in the manganese.

EFFECT OF PHOSPHORUS.

The phosphorus exists in pig iron in the form of phosphide of iron (Fe_3P). It separates out and is the last to freeze when iron containing it solidifies. The actual amount corresponding to

[illegible] per cent phosphorus [illegible] per cent (Fe_3P)
[illegible] [illegible]
[illegible] [illegible]

This phosphide forms a fusible complex eutectic with a portion of the iron and its associated silicon and carbon in the cast iron. Its composition varies with the analysis of the iron. When partially solidified iron is compressed, the eutectic associated with some of the iron can be squeezed out of it. On treating [illegible] pig in this way, I succeeded in extracting a fusible [illegible] containing [illegible] per cent. phosphorus.

The microscope shows that this eutectic exists as isolated patches embedded in the centre of the masses of metallic matrix, which latter are bounded by the plates of graphite. [illegible] in their continuous [illegible] the graphite [illegible]. The eutectic is hard [illegible]. When in a separate and massive state it is too hard to drill, but can be crushed to a powder in a steel mortar.

As the phosphorus increases the ralative mass of eutectic also proportionately increases. When 2 per cent. is present the phosphide is nearly 20 per cent., and the separate particles sometimes join together to form lines or planes of weakness. As a consequence such metal is very tender. In proportion to the increase of phsophorus the metallic matrix becomes weaker and weaker, the plane of fracture becomes more even and the iron does not tear in breaking but snaps suddenly.

The closer the grain of grey iron the greater the number of the isolated particles of the phosphide eutectic. Phosphorus does not have any influence on the carbon condition unless the quantity is very great when it appears to favour some of the carbon existing, in the combined condition. It does not appear to influence the chill, excepting perhaps to make a defined sharp division between the chilled and unchilled portion. It is believed to decrease the shrinkage, but it is probable that although test bars do apparently indicate that such is the case, the apparent non-shrinkage in a longitudinal direction may be more than compensated for by shrinkage in other directions, due to the peculiar plastic character phosphorus gives to iron below the point of primary solidification. More research is required in this direction.

PRACTICAL SUGGESTIONS.

To those who wish for the introduction of scientific methods into their foundries the following points should be remembered :—

An analyst who has no metallurgical knowledge is only useful for supplying true analyses, but in that respect he is indispensable.

Foundries rarely have fully trained metallurgists to control the mixing and casting of metals.

If there is a metallurgist in the foundry he will be able to usefully apply the analyses provided by the chemist.

The foundry [illegible] and in getting a [illegible] should be [illegible] who has had a [illegible] training in [illegible] and Guilds [illegible] metallurgy of iron and steel [illegible] It is [illegible] practical experience in a foundry, and the [illegible] develops into a useful metallurgist must largely depend upon his ability and capacity for gaining knowledge.

One of his duties should be to read everything published on foundry work, and to ensure that he does this he should supply periodically to the head or principal a review of the publications. He should ascertain the best chemical composition for any particular class of work, and castings which have given maximum good service should be obtained and analysed. All castings which have gained a high reputation should be tested, and portions of castings which have failed should likewise be analysed. In this way real knowledge will be obtained, and a solid foundation laid, for he will know what to aim at and what to avoid.

It may be accepted as a general rule that the value of any average brand depends upon its composition that is to say, if a mixture of several brands has the same composition as that of any other brand, the metal will have the mechanical properties of that brand. For instance, it is easy to make a mixture from irons in this district which will have all the good properties of any of the Scotch brands.

If the output of a foundry does not justify the employment of a metallurgical analyst, the makers of pig iron should be asked to provide analyses with each delivery to an approximate specification, and if an extra price is demanded for this, say sixpence to a shilling per ton, it should be paid. They will be worth it.

Some owners of foundries have informed me that they would have great difficulty in introducing analytical control into their works owing to the prejudices of the foremen. Of the foremen who hold such prejudices it may be said that they are working with their left hand only. If they themselves would demand analyses they would then be able to work with their right hand also. An analytical metallurgist in their works would be found as valuable in the conduct of the establishment as the secretary, accountant, or the timekeeper.

CONCLUSIONS.

I have sought to bring to a focus the experience of those who have applied their attention to the application of science to cast iron foundry practice and have endeavoured to outline a system for those who have not as yet seen the necessity for working on scientific lines, but who in the natural order of things, will eventually find it to their advantage to do so. I have, however, just touched on the fringe of the subject. The influence of correct casting temperature on the properties of the iron, the management of the cupola and air furnaces, the best composition for moulding sand, etc., have not been discussed but in these directions science can be and has been brought to bear. I can fittingly close by quoting a statement made by Mr. Moldenke, in a paper on the physics of cast iron read before the American Institution of Mining Engineers in February, 1904, who says "The American founder has come to realise that the chemical specification alone is the best safeguard" and that "in dollars and cents, the benefit of science to the much neglected foundry industry in America has been incalculable."

LAUNCHES.

The Countess Fitzwilliam gracefully performed the ceremony of naming the fine large twin screw steamer *Aragon*, launched from the yard of Messrs. Harland and Wolff, Ltd., on the 23rd instant. This steamer marks an epoch in the history of the R.M.S.P. Company, one of the oldest and now recognised as one of the most progressive of British Steamship lines. In addition to being the finest vessel in the R.M.S.P. fleet the *Aragon* will be the largest steamer engaged in the South American trade. Her dimensions are: length 527 ft. 6 in., beam 60 ft., with a gross register of about 10,000 tons. The *Aragon* is designed to carry a large quantity of cargo, but passenger accommodation on the most sumptuous scale is her speciality. She is fitted with Messrs. Harland and Wolff's latest "Balanced" quadruple type of engines.

There was launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders, Selby, on Wednesday, the 22nd ult., a handsomely modelled steel screw trawler, the principal dimensions being 123 ft. 6 in., by 22 ft. by 11 ft. 6 in. depth of hold. The vessel has been built to the order of the Grimsby Union Steam Fishing Company, Ltd. (Messrs. Letten Bros.), Grimsby, and is being fitted with powerful triple expansion engines by Messrs. Charles D. Holmes and Co., Hull.

Messrs. W. J. Tatem and Co., of Cardiff, have launched from the Pallion Yard of Messrs. William Doxford and Sons, Ltd., another large turret steamer, the s.s. *Wellington*, designed to carry [illegible] tons deadweight. Although the *Wellington* was the first vessel of this type contracted for at Cardiff several of these turret steamers have already been completed and others are in hand for Cardiff owners.

APPLICATION OF ELECTRICITY TO INDUSTRIAL PURPOSES.

A paper on this subject was read before the North-East Coast Institution of Engineers and Shipbuilders by Mr. J. F. C. Snell, M.Inst.C.E., on Friday last.

The following is an abstract of the paper:—

The author said that in this connection there were important points to be considered, such as the comparative economy between installations (for the driving of machine tools) laid down at the works themselves, and the purchase of electricity from an outside power station owned by either a separate company or by the municipality, and the comparative advantages of direct current and alternating polyphase currents. The managers of works had also to consider their position electrically with respect to the Board of Trade and the Home Office, and there was in addition the importance and economy of standardisation to be considered.

Through the kindness of members of the Institution referred to above the author is able to record the actual results of electrical stations owned by two large shipyards, one of which is being partly driven by its own steam-driven plant, and partly from a town supply, these two systems being entirely separate from one another. The other example is that of a shipyard supplied from its own gas-engine-driven generating plant. In these two examples there is a variation in cost per unit from separately driven plant of respectable dimensions from 1·05d. to 1·173d. The author has always contended that in works requiring from 300,000 to say 1,000,000 units per annum and with a load factor of 20 to 30 per cent., the cost will be found to vary from 1·25d. per unit to 1d., and he is of opinion that, looking at the question broadly and taking into due account an adequate depreciation of plant and average cost of upkeep for, say, a period of twenty years, 1d. is about the lowest limit for installations of the size stated. There are special cases, of course, in which, either through an abnormal and excellent load factor, or through the utilisation of blast-furnace gases, the cost is materially reduced blow this figure. These, however, are quite the exceptions.

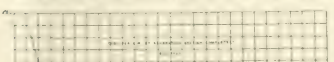


FIG. 1. CURVE SHOWING RELATION OF COST PER K.W. BETWEEN STATIONS OF VARYING CAPACITY.

SUPPLY FROM OUTSIDE SOURCES.

Turn to the other side of the question, viz., supply to works from outside sources. The first and most obvious saving is in the capital outlay per kilowatt. The following curve gives the relation of the cost per kilowatt (one kilowatt = 1⅓ h.p.) between stations varying from 250 kilowatts up to 10,000 kilowatts.

Secondly, it must be equally obvious that, while a decent load factor of anything between 15 and 35 per cent. even may be obtained in an independent installation, yet the combination of a dozen and, *a fortiori*, several dozen such works in one station must result in a far better load factor, which is actually in practice found to be anything from 45 to 55 per cent. This improved load factor at the resultant station due to the non-synchronism of the various maximum demands on the several works is known as the "diversity factor." This diversity factor really has a high value. The author knows examples where the resultant maximum load at a generating station is only some 60 per cent, of the integrated total of the maxima. This, obviously, means that a given amount of plant installed at the power station is able to deal with a much larger total of horsepower of motors installed in various works than the same plant could possibly deal with if it were split up into a number of small independent installations.

The scale of prices upon which a power station may be reasonably expected to supply current is shown in the accompanying diagram (fig. 2). This scale is based upon the practical capital cost of a large power station equipped with modern appliances, and the remaining figures of fuel, stores, wages and other establishment charges are taken from actual practical results.

Reference to fig. 3, which deals with the cost of a small local station installed for the supply of large works, demonstrates at once the influence of the capital cost upon the units generated and the economy which can be obtained from the concentration of many such small installations into one big power station, and even this does not account for the important detail already referred to, viz., the "diversity factor." From these two diagrams it will be possible for any director of works to see the relative cost to him for his particular factory which will result from either the town main or his own plant

ADVANTAGES OF DIRECT AND ALTERNATING CURRENT.

The advantages of the direct current are: variation of speed over a considerable range without undue loss of economy and with utmost simplicity; and in favour of the three phase motor, the utmost simplicity of mechanical and electrical construction, the total enclosure of the motor, and absence of commutator and of any wearing parts other than the bearings, which are themselves negligible.

The costs and weights of motors are in favour of the three phase type, and the only objection which one can offer to the three-phase motor is its less easy variation in speed when compared with its direct current competitor. On the whole, the author is of opinion that the simple three-phase induction motor is much more likely to gain favour than even its quite simple direct current rival. In point of efficiency the direct current motor has the advantage at present and is probably, from physical reasons, likely to continue to have the advantage.

The judicious grouping of motors or application of single motors to special tools, and the relation of their initial capital cost to the general working expenses after their installation, is in many works a complicated problem, upon which it is submitted only one who has made a special study of such applications is competent to advise. It would be unfair to the general industries of the country if, when called upon to make the necessarily great sacrifices in scrapping their original methods or driving, and substituting a more efficient electrical motor, every care were not taken to adopt at once the most economical method in outlay, and the most efficient in practice afterwards.

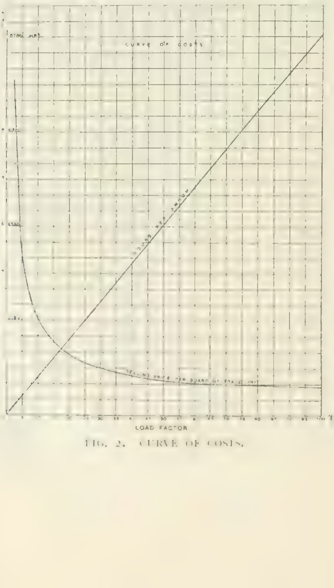


FIG. 2. CURVE OF COSTS.

The adverse criticism which occasionally falls upon electrical driving, in the author's opinion, creates a real demand for the consultation experts at the present juncture, when the tendency is so much towards the adoption of electricity as the driving agent.

The author points out that the regulations which are being imposed upon electrical users are somewhat confusing and complicated to the uninitiated.

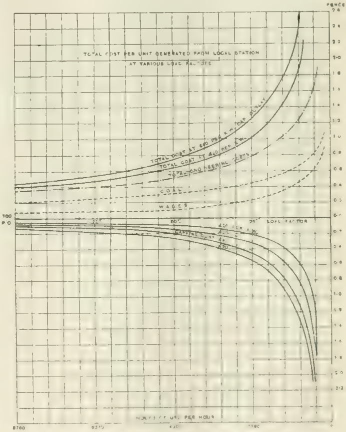


FIG. 3. SHOWING COST OF SMALL LOCAL STATION.

IMPORTANCE OF STANDARDISATION.

Wherever possible it should be the aim, in designing, to group the machinery and tools in such a way as to adopt three sizes of motors, for example, 30 h.p., 15 h.p., and 5 h.p. In this way a spare armature for each type of motor will probably be found to be sufficient, and thus the capital expenditure on spares will be considerably reduced.

It is quite true that a complication ensues in many cases from the variety of speeds at which tools have to be driven, but the author does not think that this is so bad as is made out, and in special cases, rather than instal a fourth size of motor, he would be inclined to modify the speed through gearing of some kind, even at the risk of some loss in efficiency. Then the starting switches, the switchboard panels, and instruments could be made, say, of two sizes to suit the three classes of motor, and thus there will be some system instead of the too frequent and too great variety of instruments one sees installed. In a system carefully laid out the cables can also probably be arranged to be covered by two sections. The arc lamps should be, if possible, of the same pattern, and the resistance or choking coils in connection with them should be of precisely the same pattern. Thus a very simple and easily understood system will be adopted with a resultant minimum first cost.

TECHNICAL SOCIETY NOTES.

Everybody being agreed that overhead mains are desirable by reason of their low comparative cost, Mr. Addenbrooke's paper on the subject which was discussed at the last meeting of the Institution of Electrical Engineers found each speaker taking the affirmative. It fell to Mr. John Gavey, of the Post Office, to open the debate. He noted that Mr. Addenbrooke's figures only made provision for three wires, and he doubted whether that number would suffice. Another point to be noted was that three-phase transmission on open wires caused a good deal of inductive disturbance, and he was afraid that the carrying of overhead wires along main roads in the neighbourhood of telegraph and telephone wires would set up such disturbance. At the same time he admitted the difficulty of obtaining private way-leaves.

Mr. R. S. Portheim rather controverted that view, stating that his firm, which was associated with a North Wales Power Company, absolutely dependent on overhead mains for commercial success, had experienced little or no difficulty in regard to way-leaves for a [illegible] volt system. Private owners had been reasonable, and the same might be said of the Board of Trade. Mr. C. P. Sparks had also a good word to say for the Board of Trade, and he reproached Mr. Addenbrooke for his attack on that Department. Local Authorities and not the Board of Trade were the stumbling block in country districts, and he was of opinion that the solution of the way-leave difficulty was to work along main roads other than those used by the Post Office for their wires.

Mr. Kensit gave it as his experience that the average cost of private way-leaves was about £20 per mile per annum. Another critic regretted that he had not had the same happy experience in respect to way-leaves as Mr. Portheim. Much was often made of the dangers arising from the breaking of overhead wires carrying high-tension currents, but his experience showed these fears to be groundless. Mr. Pooley thought that whatever might happen in country districts it would be necessary to feed underground in towns, and therefore with an extension of the overhead system in this country, cable makers, instead of regarding it as a rival, might look upon such a system as the opening up of a fresh field of enterprise.

Mr. Addenbrooke had really little to answer in the way of criticism, but with regard to the Board of Trade, whilst acquitting the electrical officials of that Department from all blame, he stoutly maintained his ground, definitely referring to "stubborn resistance" and darkening the air of the hall with dreadful hints of what he knew. Finally coming to something more technical, he said that the use of spans up to 150 yards for overhead mains would further cheapen the cost.

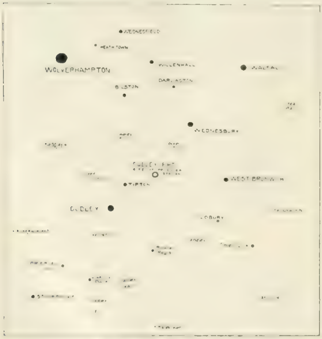
An interesting paper on "Engineering Expert Evidence," contributed by Mr. [illegible] Reade, was read at a meeting of the Civil and Mechanical Engineers' Society yesterday. The expert's position when giving evidence is, [illegible], somewhat peculiar. He is to some extent an advocate, but without the freedom enjoyed by [illegible] not expected to be impartial; on the contrary, it is his duty to seize upon and make the most of every point in his client's favour and [illegible] everything which may be pleaded against him. An expert is [illegible] expected to do this, but in a manner only less obvious [illegible]. The best witness is one who, [illegible] of his functions most effectively, and while appearing to be impartial, is merely making a strong case for his employer, or [illegible] the opponents' case. [illegible]

The author of the paper to be read at the meeting of the Society of Engineers on Monday next is Mr. Benjamin H. Thwaite, and the subject is "The Transport Possibilities of our Inland Navigation." It is an important problem, and it will be surprising if Mr. Thwaite does not make a valuable addition to the literature of the subject.

Power Gas Distribution from Dudley Port.

THE completion of the first unit of the Mond gas producer plant, erected at Dudley Port by the South Staffordshire Mond Gas Company, for the supply of gas to consumers in the district, marks an important stage in power development, and will be watched with much interest by engineers in other parts of the country. It is certainly worthy of careful attention, whether from the point of view of the manufacturer, anxious to reduce the cost of running his machinery, the colliery manager dealing with the difficult problem of small coal, or those who are directly concerned in the development of the gas engine.

The company were authorised by Act of Pariament to acquire seven sites, aggregating 134 acres, on which to establish works. The site finally selected for the first manufacturing station is at Dudley Port, and there a plant has now been erected. The site at Dudley Port extends to about 40 acres, and is designed to ultimately contain four complete units, each capable of producing 1,000,000 cubic feet of gas per hour. So far, however, only one unit has been erected, and our contemporary, the Gas World reports that this is now standing in readiness for the completion of the laying of the distribution mains, which work is expected to be finished in a few weeks' time.



DUDLEY PORT IN RELATION TO THE NEIGHBOURING TOWNS

The leading main from the manufacturing station is 36 in. in diameter, and this is led to Ocker Hill, where it branches off into two 30 in. mains, one leading through Bilston to Wolverhampton and the other through Wednesbury to Walsall. These are again sub-divided and reduced as they proceed. The compressing plant at the station has been designed to send the gas out at an initial pressure of 7 lb. per square inch. As there is no storage for gas beyond what is provided by the mains, it became essential to provide some automatic means of regulating the supply to the demand, and this, we are told, has been successfully done. Indeed, the whole installation has been designed in such a manner as to reduce human labour to what may be called an irreducible minimum.

Both station meters and consumers' meters are of the Thorp rotary type. The station meters are each capable of passing 500,000 cubic feet of gas per hour. The capacity of the consumers' meters will, of course, vary with the requirements of individual customers.

DETAILS OF THE PLANT.

It was recently pointed out when the Junior Engineers paid a visit to this station that it occupies a position which is practically the industrial centre of gravity of the district. The following is the description in brief which was furnished on this occasion: The first central station has been designed for four units, each of eight producers, and the first unit is now erected together with a complete set of spare towers. Each producer is capable of gasifying one ton of coal per hour throughout the day and night. The central station is well supplied with railway and canal facilities for the cheap handling of the coal, and it is expected to use the common slack of the district, most of which will arrive by canal boats. The coal elevators, storage bunkers, producers, superheaters, gas mains, mechanical washers, and towers, all stand in the open, and can be readily inspected.

In the lead acid towers the gas meets a down-flowing stream of acid liquor which absorbs the ammonia contained in the gas, forming sulphate of ammonia, which is afterwards converted into the marketable crystals of this material in a separate brick building known as the sulphate plant. The iron towers serve the purpose of cooling the gas and condensing the steam contained in the gas when it leaves the producers for heating and saturating the air blast on its way to the producers, and for cooling the water required for the final lowering of the temperature of the gas. It should be noticed that the hot water obtained from the towers in which the gas is cooled is made use of in the air tower for heating the blast and saturating the steam.

The main building is divided into the boiler house, the machinery house, and the pump house. Steam is raised by means of "Climax" tubular boilers arranged for burning small coal with forced draught, and also for firing by gas. The two systems can be used simultaneously or separately. In the machinery house will be found the Fraser and Chalmers' Compressors required to put the gas under pressure for distribution, also the two vertical Westinghouse gas engines for supplying power for the various electric motors used in connection with the plant, and for lighting purposes.

The pump room contains the necessary pumps for circulating hot and cold water and acid liquor through the various towers, also the blowing sets for supplying air under pressure to the producers, and, lastly, the rotary purifying apparatus for the final treatment of the gas. The floor of the buildings is of the granolithic type, being of concrete and steel, and beneath it is a basement traversed by the various pipes required to connect the different pieces of plant. This arrangement gives a clear floor space, and obviates the usual unsightly crowding of pipes overhead.

The separate buildings are the sulphate plant, meter-testing house, oil stores, workshop stores and offices. The small gasometer which may be noticed is not connected with any storage of producer gas, but is for the accurate testing of the rotary meters to be used on the distribution system.

The pipes for conveying the gas to Wolverhampton, Walsall and intermediate towns, have now been laid. They are mostly of the steel locking bar type manufactured by Mephan Ferguson, and all tested to 300 lb. per square inch before laying. A special form of steel screwed pipe has been adopted for the branch mains.

The accompanying sketch map will serve to show the importance of the district and the admirable situation of the new plant both as regards proximity to the coal pits and to manufacturing towns.

PARLIAMENTARY POWERS.

The South Staffordshire Mond-Gas (Power and Heating) Company's Act under which the scheme has come into force was passed in 1901. The first directors of the Company were Joseph Bruce Cochrane, Gilbert Henry Claughton, Sir Benjamin Hingley, Bart., Edmund Howe, George McPherson, Ludwig Mond, and two others. It gives the Company power to acquire lands and to lay mains under the roads subject to certain well-defined restrictions, and provisions for the protection of the local authorities within the district. The capital of the Company was fixed at £1,000,000. The Act provides that every owner or occupier of premises requiring a supply of gas shall:—

> Serve a notice upon the Company at their office specifying the premises in respect of which such supply is required and the day (not being an earlier day than a reasonable time after the date of the service of such notice) upon which such supply is required to commence:
>
> Enter into a written contract with the Company (if required by them so to do) to take not less than one million cubic feet per period of thirteen weeks and to continue to receive and pay for a supply of gas for a period of at least two years.

Among other provisions the Act states that the Company need not supply any person with gas unless such person is willing to contract for a supply of not less than 1,000,000 cubic feet in a year nor are the Company to supply gas for use in private dwelling houses.

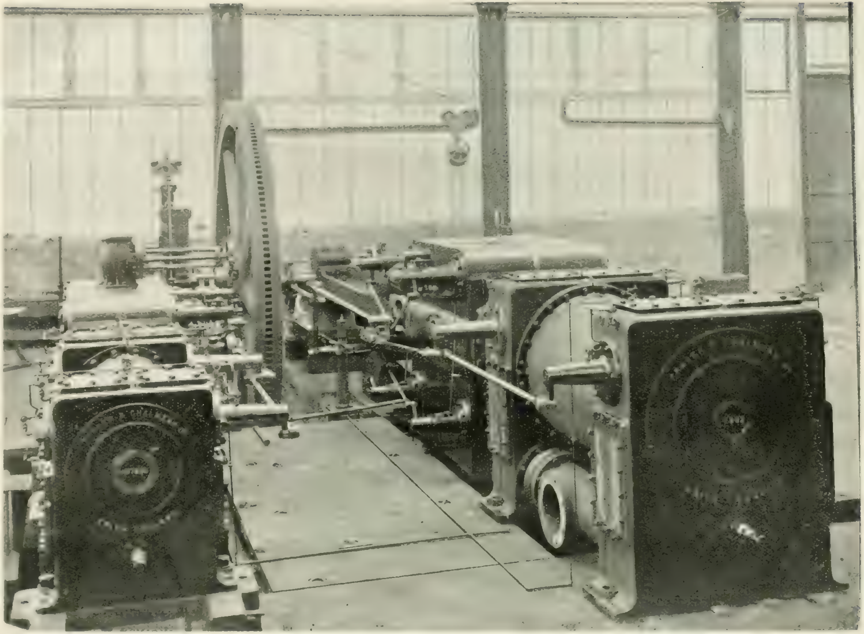
The Company is not allowed to supply gas for the purpose of illumination under heavy penalties. A penalty is also provided for failure to supply, and the Act further states:—

> It shall not be lawful for the Company at any time to supply gas (A) which contains more than fourteen per centum of carbon monoxide: or (B) which does not possess a distinctive and readily perceptible smell.

Each generating station must be provided with apparatus for the purpose of testing the thermal power of the gas supplied and the presence of carbon monoxide in the gas.

As to the minimum heating value of gas it is provided that the gas supplied by the Company shall have a minimum heating value of 125 British thermal units per cubic foot at 32 deg. F. and 30 in. of mercury pressure, the product of combustion being cooled to 60 deg. F.

The Company may charge and receive in respect of gas supplied by them such sums as may be agreed between them and the consumer, being at a rate of price not exceeding threepence per one thousand cubic feet, if the quantity taken by the consumer be not less than four million cubic feet per quarter of thirteen weeks, and not exceeding fourpence per thousand cubic feet if the quantity taken by the consumer be less than the above.



TYPE OF COMPRESSOR PLANT SUPPLIED BY FRASER AND CHALMERS, LTD., FOR USE AT DUDLEY PORT.

The capacity of each of the three engines employed at Dudley Port is 3,130 cubic feet of gas per minute, which is compressed to 7 lb. per square inch, the steam pressure being 115 lb., speed 80 r.p.m. The size of the steam cylinders is 18 in. and 18 in., gas cylinders, 40 in. and 40 in., stroke 42 in.

Provided that if at any time it be proved to the satisfaction of the Board of Trade that the price of good quality slack exceeds the price of six shillings per ton delivered at the works of the Company, then the Board of Trade may, by order, authorise an increase in the price of gas, beyond the above maximum by one eighth of a penny per one thousand cubic feet for every one shilling by which the price of slack per ton shall exceed the price of six shillings per ton delivered at the works of the Company, or by such other proportionate amount as the Board of Trade may determine, and for such period in either case as the Board of Trade may fix, with power to the Board to extend any such period, so long as such excess of price continues."

THE POSSIBILITIES OF GAS.

Concerning the possibilities of power gas to which this scheme may be said to offer a practical introduction we cannot do better than turn to the report of the Coal Commissioners. Professor Burstall in his evidence incidentally gave the following account of the Mond process and added some interesting anticipations on the subject of power gas and gas engines.

THE MOND PROCESS.

Taking the best known form—that of Dr. Mond—it may clear matters to describe the formation of gas from common bituminous coal or slack. The coal is filled into a dome shaped vessel; it is here heated, and some of the gas is formed. This gas passes through the higher portion and part of the tar is destroyed. The temperature of combustion is kept very low by means of the large quantity of steam blown in with the air (2½ tons of steam per ton of slack). The object of blowing in the steam is to keep the temperature of combustion lower and also it contributes to the formation of gas of regular composition. The hot gas on leaving the producer passes into a regenerator, where some of its heat is given to the incoming air and steam; from thence the gas passes to the washers, where any unburnt carbon is removed.

If ammonia recovery is desirable the gas is led through an acid tower, where it meets a solution of ammonia sulphate, together with a small proportion of free acid, the ammonia combining to form sulphate of ammonia; the gas then passes through the cooling tower and the air tower, and is now ready for use either in gas engines or for heating purposes. The composition of producer gas made by this method is:—

1. Carbon Monoxide .. .. .. 11 per cent
2. Hydrogen 29
3. Marsh Gas 2
4. Carbon Dioxide 16
5. Nitrogen 42

The calorific value is about 140 British thermal units per cubic foot—that is about a quarter of the calorific value of lighting gas. The amount of gas produced per ton of slack varies, but is about 140,000 cubic feet per ton. The heating power of the gas as compared with the original heating power of the coal is about 84 per cent., but it must be borne in mind that whether for heating or power purposes a fuel can be used much more economically in the gaseous form than in the solid.

The value of the ammonia sulphate recovered per ton of slack is about 4s. 6d. which represents about three-quarters of the cost price of the slack if the situation of generation is favourable. The ammonia recovery is however only financially possible when the plant is of a large size. The ideal case for the manufacture of producer gas is to place the installation as near as possible to the pit mouth, thus saving the carriage. The small and inferior coal could be gasified, while the larger and better quality of coal could be shipped to other districts. In general, however, we may assume that, except for the raising of coal, there will not exist in the neighbourhood of the pit any considerable demand either for power or gas. It, therefore becomes imperative either to turn the gas into electrical energy on the spot and to transmit to those points where a demand for energy exists, or to transmit the gas itself in pipes.

TRANSMISSION OF THE GAS.

By far the largest consumption of coal is that used for heating, whether for manufacturing purposes or the warming of buildings; for this reason it is desirable, if possible to transmit the producer gas itself into those neighbourhoods where a demand exists not only for lighting and power but for heating. The obvious difficulty is of course the size of the mains. To transmit gas of such a low heating value in such a manner as to be able to sell gas at prices which would compete with that of raw coal it is necessary to use pressures in the gas mains very largely in excess of those used in lighting gas mains; the question of leakage need not be a serious one if a properly designed joint be employed.

Considerable experience on leakage from mains under pressure has been obtained from experiments on the air main in Paris, where the pressure is about [illegible] lb. per square inch and the length more than [illegible] miles. It was found that a leakage of less than 4 per cent per mile could be obtained, and this with a network comprising a comparatively large number of branches and valves to customers. I see no reason to doubt the fact that on long mains, with comparatively few branches and valves, the leakage could be reduced to less than one tenth per cent.

per mile. In the case of transmission, the only unavoidable loss is that due to friction, and this loss is extremely small if the velocities do not exceed about 50 ft. per second. The very high efficiencies which could be obtained in transmitting air or gas do not seem to have received that attention which they deserve until recently.

I have calculated the power transmitted by a 48-inch main under different conditions of pressure and velocity; it has been assumed that one brake horse power per hour can be obtained from 70 cubic feet of producer gas per hour.

It will be noticed that for pressures up to about four atmospheres that is, 44 lb. per square inch gauge pressures, and a moderate velocity of 30 feet per second, it is possible to obtain efficiencies above 87 per cent. with a transmission of eighty miles, the power transmitted by the main at full load being 75,000 h.p.; at lower loads, where the velocity is smaller, the efficiencies will be higher as the loss in the main varies as the square of the velocity. These efficiencies are considerably better than those obtained from electrical transmission. The question of the capital cost of the gas mains as against those of the electric mains cannot be stated in general terms, as much depends on the particular locality, but there is no reason to consider that the cost will be greater than for a given amount of power transmitted electrically.

These figures show that gas transmission has an extremely high efficiency if the velocities can be kept down. I estimate that of the total gas produced, 60 per cent. would be used for heating. It is well known that the fluctuations in the demand for gas for heating purposes are much smaller than those for lighting and power. It is fair to assume, as the ratio of mean to maximum for this portion of the output would be 50 per cent., that the load factor of the whole plant would be 30 per cent. for the heating gas, and the remaining 40 per cent. would be used in gas-driven central stations producing 3-phase currents at pressures from 5,000 to 15,000 volts, according to the size of the districts which they had to cover. At these same stations the gas would be distributed at low pressures, so that no serious difficulty from leakage need be anticipated; the 3-phase current could be converted at suitable sub-stations into continuous current at 440 volts for use on trams and for lighting.

(*To be continued.*)

Table giving the length of transmission, H.P. transmitted, I.H.P. required for compressing, and the efficiency for a gas transmission through a main 4 feet diameter, 70 cubic feet of gas per brake horse-power hour. Mechanical efficiency of compressor =·8, compression curve taken as P.V. 1·3 = Constant.

Initial Pressure Absolute.		Length of transmission in Miles.			Horse-power of Gas delivered by Mains.			I.H.P. required to compress the Gas.			Efficiency of Transmission V = 20, 30 or 40.
Lbs. □″	Atmospheres.	Initial Velocity in feet per sec. V. V = 20.	V = 30.	V = 40.	V = 20.	V – 30.	V = 40.	V = 20.	V = 30.	V = 40.	
15	1·02	7·66	3·4	1·92	13,130	19,200	26,260	30	44	60	99·7
15·4	1·05	18·6	8·2	4·65	13,550	19,800	27,100	65	95	130	99·5
16·2	1·1	34·5	15·3	8·6	14,150	20,700	28,300	116	171	233	99·2
17·6	1·2	61	27·1	15·2	15,500	22,600	31,000	273	399	545	98·2
22·0	1·5	133	59	33	19,300	28,350	38,750	780	1,120	1,535	96·2
29·4	2	150	66	37	28,850	37,820	51,600	1,780	2,610	3,565	93·4
44·1	3	178	79	44	38,750	56,700	77,500	4,500	6,596	9,000	89·6
58·8	4	182	83	46	51,650	75,500	103,200	7,780	11,400	15,550	87·0
73·5	5	191	85	48	64,600	94,600	129,100	11,550	16,910	23,100	84·9
88·2	6	194	86	48·5	77,500	113,500	155,000	15,890	23,290	31,875	83·0
102·9	7	196	87	48·9	90,300	132,000	180,700	20,630	34,560	41,370	81·5

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day

Johannesburg.—Supply of 100 electric cars, two electric water-cars, five-ton crane, car traverser, and workshop tools for Municipal Council . .. March 6

Manchester.—Laying underground telephone pipes (Contract No. 11), with other appurtenant works for the Paving, Sewering, and Highways Committee. City Surveyor's Office, Town Hall, Manchester March 6

Birmingham.—Supply and delivery of 1,500 tons of 7-inch tramway rails, British standard section No. 4, and 150 tons British standard section No. 4 4C, with all necessary fishplates for same, for the Public Works Committee. Mr. John Price, city engineer and surveyor, City Surveyor's Office, Council House, Birmingham ... . March 7

Altrincham.—Supply and delivery at Altrincham railway station of about 45 tons of steel girder rails, with the necessary fishplates, tiebars, bolts, nuts, washers, etc., for the Gas Company. Messrs. John Newton, Son and Bayley, 17, Cooper Street, Manchester . . . ... March 8

Stoke Newington.—Supply, delivery and erection of sub-station plant and mains. Four-section contract. Mr. W. F. Loveday, Borough Surveyor, Town Hall, Milton Road, Stoke Newington, S.E. ... ... March 8

Broadstairs.—Construction, delivery, and erection at the above station of a horizontal tandem compound engine, condenser, well pumps, and all accessories. Mr. Percy Griffith, M. Inst. C.E., 54, Parliament Street, S.W. March 11

Brighouse.—Widening of the Calder Bridge, Brighouse, by means of steel lattice girders and steel stanchions for the Corporation. Mr. S. S. Haywood, Borough Engineer, Municipal Offices, Brighouse March 11

Belgium.—The "Bulletin Commercial" announces that the Belgian State Railways invite tenders for the installation of two sets of ventilating and heating apparatus in the central workshops at Mechlin. Particulars of M. Slaghmuylder, Engineer in chief, Station du Nord, Brussels. March 6 March 13

Park Royal.—Supply, delivery, and erection of plant in connection with the electricity generating station at Park Royal and proposed sub-station and distributing centre at [illegible] place, for the Great Western Railway Company. Messrs. Kennedy and Jenkin, 17, Victoria Street, S.W. March [illegible]

Axbridge (Somerset).—Supply of about 600 tons of cast-iron socket water pipes, 7-in. to 3-in. in diameter, for Axbridge Union Rural District Council March [illegible]

Last Day

South Shields.—Supply, delivery and erection of the following plant in connection with the electricity supply department: One multitubular marine type boiler, two medium-speed open-type vertical engines for two 550 k.w. direct current traction generators, two 500 k.w. direct current generators and traction switchboard. Mr. J. H. Cawthra, Borough Electrical Engineer March 13

Liverpool.—Construction of covered conduit about 1,100 yards in length, and other works connected therewith, situated in the townships of Withnell and Wheelton, in the county of Lancaster, for the Water Committee of the Liverpool Corporation. Mr. H. Dawkin Williams, Surveyor, Bryn Menin ... ... March 14

Llandyfodwg and Llantrisant (Wales).—The Ogmore and Garw Urban District Council invite tenders for two distinct and separate schemes of bridging the valley at Gilfach, by extending Coronation-road, Evanstown, in the parish of Llandyfodwg, to join the highway known as Gilfach road, in the parish of Llantrisant. Mr. H. Dawkins Williams, Surveyor, Bryn, Menin . . .. March 14

London.—Supply of electrical stores for year ending March 31, 1906, for the Fulham Borough Council. Town Clerk, Town Hall, Fulham . . . . March 15

Welwyn.—Supply and delivery of about 58 tons of 9-inch cast iron pipes, for the Welwyn (Herts) Rural District Council. Messrs. Herbert Walker and Son, Albion Chambers, King Street, Nottingham March 27

Grindleford and Rowsley.—Construction of the Grindleford to Rowsley section of the Derwent aqueduct in the county of Derby, for the Derwent Valley Water Board. Mr. Edward Sandeman, Engineer, Bamford, Sheffield March 27

Shanghai.—The Shanghai Municipal Council invite tenders for the construction and operation of about 24 miles of electric tramways on the trolley system in the [illegible] of the Settlement of Shanghai; [illegible] proposals are desired for the [illegible] [illegible] Messrs. [illegible] and Co., [illegible] Street, London, E.C., or Messrs. [illegible] Wall Street, New York March [illegible]

Newport (Mon.).—Construction of [illegible] Western Valleys Sewerage Board [illegible] Mr. Baldwin-Latham [illegible] Mansions [illegible] S.W.; Mr. [illegible] S.W.; or Mr. J. S. Edwards, [illegible] Board, Newport, Mon. .. April [illegible]

COMING CONTRACTS.

Panama Canal.—The last plans which have been laid before the Commission deal with the construction of a sea-level canal at a cost of over £45,000,000, which would take 10 to 12 years to construct.

Blyth.—The Harbour Commissioners have under consideration a scheme for widening and deepening the middle and upper harbours at an estimated cost of £21,000.

Cumberland.—The proposed electrical installation at the Cumberland lunatic asylum is estimated at £6,600.

Grimsby.—The construction of a light railway has been sanctioned in connection with the proposed new dock at Grimsby. The line will run from the proposed dock area at Immingham into the borough.

Bath. The City Council are about to apply for a loan of £10,000 for electric supply extensions.

Warwick.—Tenders for sinking a well in connection with new scheme of water supply prepared by Messrs. Willcox and Raikes have been received, and the engineers instructed to obtain tenders for the laying of mains, provision of pumping machinery, and erection of engine-house.

Hartlepool.—At the annual meeting of the Hartlepool Port and Harbour Commissioners, the Chairman stated that it would be necessary shortly to obtain sanction to borrow £30,000 or £40,000 for further dredging plant.

CONTRACTS CLOSED.

Karachi.—Messrs. Wm. Simons and Co., Ltd., Renfrew, have received an order from the Karachi Port Trust for a very powerful hopper dredger of 1,250 tons hopper capacity being a duplicate of a dredger which they supplied to the above Trust about six years ago. The vessel is specially constructed to dredge hard material.

Worksop.—Messrs. Markham and Co., Ltd., Chesterfield, have secured the contract for supplying the large winding engines required by the Wigan Coal and Iron Co., Ltd., for their Manton Colliery, near Worksop, also the main winding engines for the Dinnington Main Coal Company's new sinking, near Sheffield.

Islington.—The contract for a complete Ash Elevator plant for the boiler-house of the Islington Urban District Council has been placed with Messrs. Graham, Morton and Co., contractors, Leeds. The elevator is motor-driven by means of a 3-b.h.p., running at 500 revolutions per minute.

London.—The Brush Electrical Engineering Company have received an order for carbodies, with radial trucks and equipments, from the Yarmouth Corporation.

London.—J. Williams and Sons (Cardiff), Ltd., have secured an order for 1,500 tons of castings for one of the London tube railways.

Japan.—Robert Stephenson and Co. Ltd., have just received an order for ten large passenger engines and tenders for the Indian State Railways. The engines are passenger engines, six wheel coupled with leading bogie, and six-wheel tenders, cylinders 19 in. × 26 in.

Portsmouth.—Alley and Maclellan, Glasgow, have recently received orders from the Admiralty for two air compressors for Portsmouth Dockyard.

Bishop Auckland.—We are informed that Graham, Morton and Co. have obtained the contract to extend the coal-screening plant for the Dean and Chapter New Colliery at Bishop Auckland, County Durham. After the addition the plant will be able to handle 5,000 tons per day.

Liverpool.—C. and A. Musker (1901), Liverpool, have received the order from the Mersey Docks and Harbour Board for supplying and fixing eight hydraulic gate machines for the passage between Brocklebank and Canada Dock, Liverpool.

Glasgow.—Mountain and Gibson secured the contract from the Glasgow Corporation Tramways Department for 100 of their "M.G." 21 E.M. electric motor trucks for tramcars, fitted complete with steel-tired wheels and steel axles.

Buncrana.—James Gordon and Co. have obtained the contract for the supply, delivery and erection of the complete hydraulic and gas power plant for the electric light station at Buncrana, Ireland.

Middleton.—Meldrum Bros. have obtained a contract to erect a bridge, and to supply a Meldrum simplex destructor, for Middleton, Lancs.

South America.—The Leeds Forge Company, Ltd., has received an order for 500 steel wagons, each of 40 tons capacity, from a South American Railway Company.

APPOINTMENTS VACANT.

Last Day

Tredegar.—Gas and water works' engineer under Tredegar Urban District Council... March 20

Llanelly.—General superintendent of harbour, docks, and railways under Llanelly harbour trustees. Salary, £300 per annum March 16

APPOINTMENTS FILLED.

Macclesfield.—The Macclesfield Town Council have appointed Mr. Herbert Goodwin as assistant surveyor at a salary of £120 per annum.

Leigh. The Leigh Town Council have appointed Mr. Stanley Wilson, deputy town clerk of Warrington, as town clerk at a commencing salary of £400, rising by £50 annual increments to £600.

London.—The Honourable Alfred Erskine Gathorne-Hardy has been appointed to be a Commissioner under the Railway and Canal Traffic Act, 1888, in the room of Viscount Cobham, resigned. Mr. Alfred Gathorne-Hardy takes the position of Chairman of the Light Railway Commission (unpaid) in the place of the Earl of Jersey, resigned.

Rangoon.—Mr. Walter G. Longdin, of Warrington, has been appointed assistant civil engineer to the municipality of Rangoon, Burmah.

Luton. Mr. S. F. L. Fox, deputy borough engineer of Newport, Mon., has just been appointed borough engineer of Luton, and surveyor to the Education Committee of the corporation, at a salary of £350 a year. Mr. Fox will commence his duties on the 20th inst.

A correspondent requires information as to an addressing machine, printing addresses with stencils. Information addressed to the offices of PAGE'S WEEKLY will be duly forwarded.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS. Settling days on the Stock Exchange are as follows:—

Consols: April 5th. General Settlements: March 15th, 30th, April 13th. Bank Rate, April 21st, 1904, 3 per cent

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
11,270	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2¾ — 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent.	5	4½ — 5
3,210,000	1	2/6	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3[illegible] — 3[illegible]
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅜ — 5⅝
1,500,000	100	4	Do. 4% 1st Mort. Dbs. Rd.	100	103 — 105
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg Mt. Debs. Red.	100	96 — 99
530,000	1	1/7½	Babcock and Wilcox, Ltd., Ord.	1	4¾ — 4[illegible]
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1½ — 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd. 6% Cum. Pref.	5	5 — 5½
250,000	1	6½d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1 — 1⅛
£250,000	Stk	4½	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 — 103
150,000	4½	2/8	Barrow Hematite Steel Co., Ld., O	4½	1[illegible] — 1[illegible]
50,000	4½	6/-	Do. do. Cum 2nd. Pref.	4½	4[illegible] — 4[illegible]
33,534	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾ — 5¼
£500,000	100	-	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	101 — 103
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾ — 12¼
£366,000	Stk	4	Do. 4% Deb. Stock, Red	100	99 — 101
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	[illegible]
300,000	1	6½d.	Do. 5½% Cum Pref.	1	[illegible]
£300,000	Stk	4½	Do. 4½% Red Deb. Stock	100	94 — 97
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1–1,629,760	1	1 — 1⅛
1,860,900	1	3d.	Do. Nos. 1,639,101–3,500,000	12/-	[illegible]
1,160,000	1	1½d.	Brown (John) and Co., Lim., Ord., Nos. 1–1,160,000	1	1 — 1
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1 — 1
74,000	10	5/-	Do. 5% Cum. Pref.	10	11½ — 11¾
154,000	5	2/6	Cammell, Laird & Co., Ltd., Ord.	5	8[illegible] — 8[illegible]
232,500	5	2/6	Do. 5% Cum. Pref.	5	5¼ — 5½
400,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	[illegible] — 1
70,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛ — 5½
£200,000	Stk	4	Do. 4% 1st Mort. Db. Stk. Red	100	100 — 102
100,000	10	7/6	Consett Iron Co., Ltd., Ord.	7½	31½ — 32½
57,031	10	10	Crossley, Bros., Ld., Ord. 40340–97370	10	16¾ — 16¾
40,339	10	5%	Do. 5% Cum. Pref.	10	11¼ — 11¾
75,000	1	2/6	Delta Metal, Ltd. Stam	1	2½ — 2¾
1,250,000	1	3d.	Dorman, Long & Co., Ltd.	1	[illegible]
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk	100	91 — 94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	3[illegible] — 3½
270,000	1	9d.	Dunlop (James) & Co., Ltd., Ord.	1	[illegible]
300,000	1	7½d.	Do. 6% Cum. Pref.	1	[illegible] — 1
1,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9 — 10
69,754	13	12/-	Do. do. do.	10	7½ — 7¾
20,000	10	8/-	Elliott's Metal, Ltd.	8	5[illegible] — 5¾
5,000	10	5/-	Do. Cum. Pref.	10	8[illegible] — 9¼
186,718	Stk	4	Do. Deb. 4%	100	91½ — 93½
25,000	10	6	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	10½ — 11
£250,000	Stk	4½	Do. 4½% Mort. Deb. Stk. Red.	100	97 — 100
9,000	10	10	Fleming & Ferguson, Ltd. Ord. Nos. 1–9000	10	12¾ — 13
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001–15,000	10	9½ — 10
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord.	3	4⅛ — 4½
21,000	3	1/-	Do. 7½% Cum. Pref.	3	3[illegible] — [illegible]
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001–28000	10	6 — 7
£150,000	Stk	4	Do. 4% 1st Mort. Deb. Red.	100	[illegible]
16,800	10		Greenwood & Batley, Ltd., Ord.	10	4 — 4½
9,000	10	7	Do. 7% Cum. Pref.	10	10[illegible] — 10[illegible]
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2[illegible] — 2[illegible]
341,000	[illegible]	2/6	Do. 5% Cum. Pref.	[illegible]	[illegible]
£1,850,000	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105 — 107
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	2 — 3
250,000	1	1/	Hadfield's Steel Foundry Co., Ld., Ord.	1	3 — 3[illegible]
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10[illegible] — 11¼
30,000	5	3/	Hall (J. & E.), Ltd. 6% Cum. Pref.	5	[illegible]
408,505	1	1/6	Harvey United Steel Co., Ltd.	1	1 — 1[illegible]
47,500	10	7½	Hawthorn, Leslie & Co., Ltd. Ord.	10	10[illegible] — 11
28,001	[illegible]	7/	Head, Wrightson & Co., Ltd.	5	4[illegible] — 4[illegible]
85,000	1	7½d.	Hill (Richard) & Co. (1896) Ld., Ord	1	[illegible]
18,000	5	3/	Do. 6% Cum. Pref.	5	4 — 4[illegible]
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5[illegible] — 6

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
750,000	1	6d.	Howard & Bullough, Ltd., Ord.	1	1⅜ — 1[illegible]
25,000	10	6/-	Do. 6% Pref. Non-Cum.	10	12¼ — 12¾
£250,000	Stk	4	Do. 4% Deb. Stk., Red. after 1905	100	98 — 101
37,500	10	20	Kynoch, Ltd.	10	18¾ — 19¼
49,537	10	5%	Do. Cum. Pref 5%	10	10½ — 11½
300,000	1	4½d.	Lambert Bros., Ltd., Ord.	1	⅜ — ½
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1	Leeds Forge Co., 7% Cum. Pref.	3	3¼ — 4¼
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1[illegible] — 1[illegible]
£300,000	Stk	4½	Do. 4½% 1st Mt. Deb. Stk., Red.	100	108 — 110
40,000	10	5	Mather & Platt, Ld., 5% Cum. Pref	10	11 — 11½
210,000	1	6d.	Measures Bros., Ltd., Ord.	1	1¼ — 1[illegible]
75,000	1	6½d.	Do. 5½% Cum. Pref.	1	[illegible]
£75,000	Stk	4½	Do. 4½% 1st Mrt. Db. Stk., Red.	100	94 — 97
21,943	5	2/6	Muntz Metal, Ltd.	5	[illegible]
11,248	5	5	Do. Pref. 5%	5	5½ — 5[illegible]
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref	62½	76 — 80
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf	10	12 — 12¼
80,000	5		North Eastern Steel Co., Ltd., Ord	5	
£250,000	Stk	4½	Do. 4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
122,000	5	2/	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3[illegible] — 4½
50,000	5	3/-	Do. 6% Cum. Pref. "A"	5	5¼ — 6¼
70,000	10	6/	Pease & Partners, Ltd., Ord.	10	10¾ — 11¼
£400,000	Stk	4	Do. 4% Perp. Deb. Stock	100	97 — 100
20,000	5	3/-	Peebles (Bruce) & Co., Ltd., 6% Cum. P	5	4[illegible] — 5
65,000	1		Pooley (Henry) & Son, Ltd., Ord.	1	6/6 — 7/
13,000	5		Do. 5½% Cum. Pref.	5	4½ — 4[illegible]
230,000	1		Projectile Co. (1902), Ltd., Ord.	1	½ — ⅝
126,938	5	2	Rhymney Iron Co., Ltd.	5	1¾ — 2
73,062	5	2/-	Do. New	5	1½ — 1¾
£130,000		5	Do. 5% Mort. Deb., Red	100	99 — 102
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf.	1	⅞ — 15/16
£150,000	Stk	4½	Do. 4½% Perp. Deb. Stock	100	94 — 96
55,000	10	1/-	Ruston, Proctor & Co., Ltd.	10	9½ — 9¾
275,000	1	6d.	Scott (Walter), Ltd., Ord.	1	[illegible]
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1 — 1⅛
£300,000	Stk	4	Do. 4% Perp. Deb. Stk.	100	94 — 96
£115,300	100	5	Shelton Iron, Steel and Coal Co., Ld. 1st Charge Debs. Red	100	91 — 94
£97,600	100	6	Do. 6% 2nd Mort. Debs. Red.	100	91 — 95
250,000	1	1	South Durham Steel & Iron, Ltd. Or.	1	⅜ — [illegible]
300,000	1	7½d.	Do. 6% Cum. Pref.	1	[illegible] — 1
£130,000	Stk.	4½	Do. 4½% Per. Deb. Stock	100	80 — 82
19,[illegible]	10	[illegible]	Steel C[illegible]	[illegible]	[illegible]
£12[illegible],210	Stk.	5	Do. 5% Trust Mort. Deb	100	106½ — 107½
25,000	10		Stephenson (Robert) & Co., Ltd., Or.	10	2¼ — 2[illegible]
25,000	10	5/6	Do. 5½% Cum. Pref.	10	[illegible] — 4
£200,000	Stk	4	Do. 4% Perp. Deb. Stock	100	83 — 86
80,000	10	9	Stewarts & Lloyds, Ltd., Ord.	10	16¾ — 17¼
50,000	10	6	Do. 6% Cum. Pref.	10	11¾ — 11[illegible]
131,752	1	1/9½d.	Swan, Hunter & Wigham Richardson, Lim. Ord.	1	[illegible]
248,81[illegible]	1	6d.	Do. Cum. Pref.	1	[illegible] — 1⅛
£240,000	Stk	4½	Do. 4½% 1st Mort. Deb. Stk. Red.	100	98 — 101
350,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., [illegible] Cum. Pf.	1	½ — ⅝
£200,000	100	4	Do. 4% [illegible] 1st Mort. Deb.	100	67 — 71
£160,000	1	[illegible]	Thornycroft (John I.) & Co., Ltd., [illegible] Cum. Pref.	1	[illegible] — 1⅛
10,000	10	[illegible]	Tyer (J.) & Son, Ltd., [illegible] Cum. Pf.	10	9½ — 10
[illegible]	$100	[illegible]	United States Steel Corp., Com. Stk.	$100	[illegible]
[illegible]	$100	[illegible]	Do. 7% Cum. Pref. Stock	$100	[illegible]
[illegible]	$1000	[illegible]	Do. [illegible] Bonds	$1000	97 — 99
[illegible],000	1	[illegible]	Vickers, Sons & Maxim, Ltd., Ord.	1	2[illegible] — 2[illegible]
[illegible]	1	[illegible]	Do. [illegible] Non-Cum. Pref.	1	1[illegible] — 1¼
£[illegible]	[illegible]	[illegible]	Do. [illegible] Non-Cum. Pref. Stock	100	114 — 117
£1,[illegible]	Stk.	[illegible]	Do. [illegible] 1st Mort. Deb. Stk. Red.	100	105 — 107
£1,[illegible]	100	4½	Do. 4½% 2nd Mort. Deb. Red.	100	105 — 107
[illegible]	1	1	[illegible] Steel, Coal & Coke, Ltd., [illegible] Ord.	1	[illegible]
[illegible]	1	7½d.	Do. [illegible] Cum. Pref. [illegible]	1	[illegible] — 1
£[illegible]	[illegible]	4	Do. 4% Perpetual Deb. Stock	100	8[illegible] — 89
7,[illegible]	[illegible]	[illegible]	[illegible] Tubes, Ltd., Cum. Pref.	5	4[illegible] — 4½
[illegible]	Stk	4½	Do. Mort. Deb. 4½%	100	91 — 97
[illegible]	5	[illegible]	W[illegible] & [illegible], Ord.	5	1½ — 2½
[illegible]	5	[illegible]	Do. [illegible] Cum. Pref.	5	3 — 4
£240,000	[illegible]	4	Do. 4% 1st Mort. Deb. Stk. Red.	100	77 — 82
£150,000	Stk	4½	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	81 — 86

Stocks and Shares [illegible]

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝ ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	7/16 — 9/16
120,000	1	9½d.	Bell's Asbestos Co., Ltd.	1	⅝ — ¾
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5¾— 6¼
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½—5¾
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 —104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	99 —101*
400,000	5	8/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref. ..	5	2¾ 2⅞
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	87 - 89
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½ — ¾
150,000	2	2/4½	Do. 6% Pref.	2	1½ - 1¾
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	92— 95*
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	79 — 82
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	10¾ 11¼
40,000	5	2/6	Do. 5% Cum. Pref.	5	5½ 5⅝
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red.	100	105 —107
85,000	3	1/6	Crompton & Co., Ltd... .. .	3	2⅛— 2⅜
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	93— 98
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7¾— 8¼
61,000	5	3/-	Do. 6% Cum. Pref.	5	5⅞— 6⅛
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 —107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛— 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	105 —108
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	⅝ - ⅞
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1 1½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	77 82
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	79 — 84
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	1⅛— 1¼
31,390	2	2/9¾	Do. 7% Cumulative Pref. ..	2	2¼— 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 — 99
10,248	10	7/6	Evered and Co., Ltd...	10	13 — 15
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red.	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ – 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	12½ 13
35,000	5	2/3	Do. 4½% Cum. Pref. ..	5	5⅜ – 5⅝*
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111*
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	16 17
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 -103
7,500	10		Parker, Thos. Ltd.	10	6½ 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/- 16/6
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	35 — 37
£150,000	100	4%	Do. 4% Deb. Bonds	100	102 104

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
120,000	5	3/-	Anglo Argentine Trams Co., Ld., Or.	5	8[illegible] 8[illegible]
260,067	5	2/6	Do. 5% Cum Pf.	5	5½ 5¾
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	11¾ 12¼
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9 - 10
£[illegible]	100	5%	Do 5% Debs., Red. ..	100	99 102
£[illegible]	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 100
[illegible]	1		Bath Elec. Trams. Ld., Pf. Or. .	1	[illegible]
59,394	1	11·49d	Do. 5% Cum. Pf. ..	1	15/16 1 1/16
[illegible]	5		Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1¼ 1[illegible]
75,000	5	2/6	Do. 5% Cum Pf. .	5	3¾ 4¼
£425,000	Stk	4½%	Do 4½% 1st Deb Stk., Red.	100	94 — 98
£200,000	Stk	[illegible]	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock . .	100	102 105
			Pref. Ord. Stock ..	100	100 103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord..	10	9¼ 9¾
156,497	10	6/-	Do. 6% Cum. Pref. . ..	10	10¾ 11⅛
£1,000,000	Stk	[illegible]	Do. 5% Perp. Deb. Stk.	100	121 123
£250,000	Stk	4%	Do. 4% 2nd Deb. Stk. Red..	100	97 — 99
100,000	5	[illegible]	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3¾ 4
40,500	5	[illegible]	Do. "A" 6% Cum Pref. ..	5	5½ 5¾
7,000	5	[illegible]	Do. "B" do.	5	5¼ [illegible]

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend	Name	Paid up.	Closing Prices
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	94 97
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	103 – 106
102,268	5	3/-	Calcutta Tramways Co., Ltd. ..	5	8⅝- 8⅞
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	15/16 1
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞— 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101 —104
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13 14
59,987	10	6/-	Do. 6% Pref...	10	15½ 16½
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3 - 3½*
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	89 - 92
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10⅜ 10⅝
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	103 105
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	101 -103
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	[illegible]
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	15/16 - 1
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	104 - 106
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½— 1½
110,923	8	3/2½	North Metropolitan Tramways Co..	8	4 - 4½*
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock Red..	100	104 107
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8 — 9
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	8½— 9½
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	102 —105

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12¼— 12¾
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9½— 10
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red .	100	104 —106
14,000	5	2/-	Bromley (Kent) Elec Lt. & Pr. Co. Ld	5	5¼— 5¾
£50,000	Stk	4½%	Do. do 4½% 1st Deb. Stk. Red.	100	101 —104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10½ – 11
12,493	5	3/6	Do. 7% Cum. Pref. Shares .	5	10¼ — 10¾
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9 — 9¼
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec Sup. Corp., Ltd., Ord	5	7⅞ 8⅜*
80,000	5	2/3	Do. do. 4½% Cum. Pref.	5	5½ - 5⅞
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	102 —104
44,436	5	3/9	Chelsea Elec. Sply Co., Ltd., Ord.	5	6¾— 7¼*
£150,000	Stk	4½%	Do. do. 4½% Deb Stk., Red	100	109 —111
70,595	10	5/-	City of London El Lghtg. Co. Ld., O.	10	12½— 13
40,000	10	6/-	Do. 6% Cum. Pref... ..	10	13½— 14
£400,000	Stk	5%	Do 5% Deb. Stk., Red ..	100	122 126
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 —105
40,000	10	4/-	County of London Elec Supply Co., Ltd., Ord.	10	9¼ - 9¾
30,000	10	6/-	Do. 6% Cum. Pref.	10	12¼ 12¾
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	109 112
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord	5	6¼ - 6½
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 - 6¼
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	106 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
19,000	5	2/-	Folkestone Elec. Supply Co., Ld., O	5	5½— 6
£50,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 —104
15,000	10		Havana Electricity Co., Ltd... .	10	9½— 10½
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord.	5	7½ 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd 4½% Deb. Stock, Red.	100	100—102
150,000	1		Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	[illegible]
21,000	5	7/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12¾ 13¼

Stock and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 104
111,000	3	1/9¾	London Elec. Supply Corp., Ld., Ord.	3	2½ — 2¾*
60,000	5	3/-	Do. 6% Pref.	5	5¾ 6
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	98 —100
100,000	10	9/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	18¾ - 19¼
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅝ — 5¾
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	110 —115
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	97 99
£250 000	–	4½%	Midland Elec. Corp. for Power Distribution Ld., 4½% 1st Mort. Deb.	100	97 100
10,852	10	6/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½ 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	102 —104
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6¼ - 6½
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 -100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½%, 20-yr. 1st Mort. Deb	100	100 —102
40,000	5	9/6	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13¼—13¾*
20,000	5	3/6	Do. 7% Pref...	5	8¼—8¾*
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅞ 3⅛*
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	79 — 83
65,000	5	3/-	South London Elec. Sup. Co., Ltd. O.	5	4⅛— 4⅜
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅞ — 1
50,000	1	8¾d.	Do. 7% Cum. Pref.	1	1⅜ - 1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	107 —110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	5 — 5½
30,000	5	2/6	Do. 5% Cum Pref.	5	5⅛— 5¼
£200,000	Stk	—	Do. 4½% 1st Mort. Deb. Stk. Red	100	105 —107
110,000	5	7/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	13 -13½*
28,151	5	2/6	Do. 5% Cum. Pref.	5	6⅛ - 6⅜

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices
£31,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red. ..	100	99 102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2¼ 2¾
£763,580	Stk	17/6	Anglo-American Tel. Co., Ltd., Ord.	100	60 62
£3,118,210	Stk	35/-	Do. 6% Preferred Ordinary	100	107 109
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	14½ 14⅞
14,000	5	3/-	Chili Telephone Co., Ltd.	5	6½ 6¾
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	170 190
£1,903,846	Stk	4%	Do. Sterl. 500 yr 4% Deb. Stk., Red.	100	96 98
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾ 9¼
6,000	10	10/-	Do. 10% Preference	10	17 18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜ 3⅝
		5/-	10%, Cum. Preference	5	8 8½
£30,000	50	4½%	Do. 4½% Debs...	50	100-102
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11 11½
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	99 101
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	100 102
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsdy)..	25	101-103%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14 14½
£602,100	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	104 106
£1,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	140 143
£2,000,000	Stk	17/6	Do. 3½% Pref. .. .	100	89 91
£1,836,814	Stk	4%	Do. 4% Mort. Deb. ..	100	106 108
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	30¾ 31¼
£58,700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100 102
217,000	25	12/6	Indo-European Tele. Co., Ltd. .	25	46 48
72,680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	13/16 15/16
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	112 113
£1,966,667	Stk	5%	Do. Deferred .. .	100	106 108
250,000	5	2/6	Do. 5% Non Cum. 3rd Pref.	5	5½ - 5¾
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	98 —100
£689,593	Stk	4%	Do. 4% do. do. .	100	104 —106
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1 1/16 — 1 3/16
50,000	1	7½d.	Do. 6% Cum. Pref. . ..	1	1⅛ 1¼
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red. .	100	98 101
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7¼ - 7¾
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7¾ 8¼
40,000	5	2/6	Do. 5% Cum. Pref. . ..	5	5 5½
£179,947	Stk	5%	Do. 5% Deb Stock, Red. ..	100	105 108
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	7¾ 8¼
£30,008	2½	—	West Coast of America, Ltd. ..	2½	[illegible]
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	99 — 101

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	⅞ - 1
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	9 - 9½
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	8¾ 9¼
£80,000	100	5%	Do. 5% Deb.	100	102 —104
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13½— 14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	102 —104

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8½ 9
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99 —101
£672,900	Stk	4½%	British & African Stm. Nav. (1900), Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	93 — 95
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6 — 6½
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	74 77
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	98 —100
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000 .	20	13¾ 14¼
40,000	20	8/	Do. Nos. 60,001-100,000	10	6 6½
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	101 —103
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1 1/16 1 3/16
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4¼ 4¾
36,758	8	4/9½	Do. Non-Cum. 6% Pref. ..	8	7½ - 8
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	99 101
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2½ 3
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3¼ 3¾
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 - 86
141,500	10	5/-	Leyland (Fredk.), & Co. (1900), Ltd., 5% Cum. Pref. ..	10	5¼ 5¾
£1,160,000	Stk	5%	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	130 133
£1,160,000	Stk	19%	Do. do Deferred ..	100	222 225
15,000	100	30/-	Royal Mail Steam Packet Co. Ord. .	60	25½ 26½
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5%, Cum. "A" Pref. .	5	4¾ 5¼
39,075	5	2/6	Do. "B" Ord.	5	4 4½
141,841	10	1/-	Union Castle Mail Steamship Co., Ltd., Ord.	10	8¾ [illegible]
24,000	10	1/6	Do. [illegible] Cum. Pref. ..	10	9¾ 10¼
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	99 101

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
60,000	1	9½d.	Chadburn's (Ship) Tele. Ltd., Ord.	1	¾ 1⅛
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	133 138
12,500	10	10	Oakey (John) and Sons Ltd. Ord	10	24 26
10,000	10	6	Do. do 6% Cum. Pf	10	14 — 15
183,538	1	6¾d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	[illegible]
66,462	1	8¼d	Do. do Nos. 1-66,462	1	[illegible]
135,000	1	6d	Waygood (R.) & Co., Ltd., Ord. ..	1	1 1/16 [illegible]
135,000	1	7½d.	Do. 6% Cum. Pref.	1	1⅛ 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

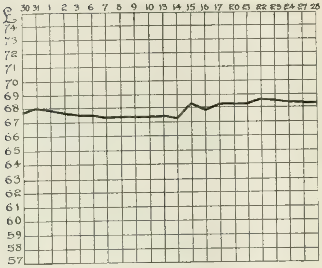
Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
10,000	10	7/6	Birm. Railway Car. & Wagon, L., 1-10,000	10	20¾ 21½
8,739	10	3/-	Do. Second Issue 1-8,739 .	4	8¼ [illegible]
10,000	10	6/-	Do. Cum. Pref. 6%, 1-10,000	10	13 13½
30,111	7	7	Gloucester Rail. Car. & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9 9½
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 4½
14,367	10	1/3	Lancashire Wagon, Ord. . ..	2	2⅛ 2⅜
1,150	10	5%	Do. do. . .	10	10½ [illegible]
781,808	1	9d.	Metropolitan Amalgamated Rail. Carriage & Wagon, Ld., 1-781,808	1	41/ 42/
164,288	1	6d.	Do. Cum. A Pref. 5%, 1-164,288	1	23/6 24/
235,000	1	7½d.	Do. Cum. B Pref. 6%, 1-235,000	1	28/ 28/6
20,000	20	20/	Midland Rail. Car. & Wagon, L.d., 1-20,000	10	19 19½

Stocks and Shares marked * are quoted ex-dividend.

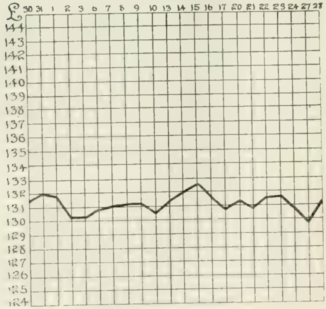
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM JANUARY 30TH TO FEBRUARY 28TH, 1905.

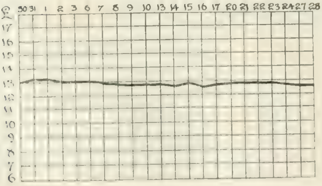
COPPER.



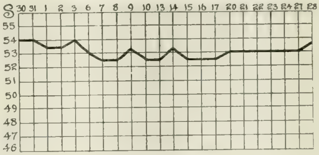
TIN.



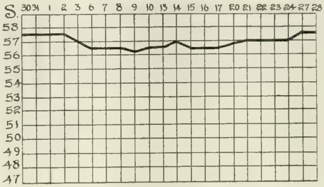
ENGLISH LEAD.



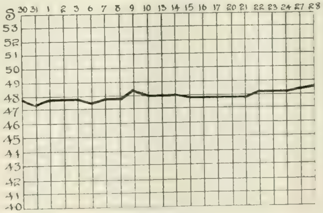
PIG IRON: SCOTCH,



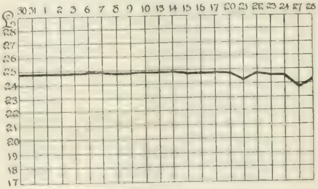
HEMATITE,



CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, March 1st, 1905.

COPPER has fulfilled the prediction made in this column by rising to a higher value. American advices have been very strong, and have materially assisted the advance in values. It is understood that consumers have allowed their stocks to run down to a low level, and if the market were subjected to manipulation copper might easily be put to £70. The statement is made that the Rio Tinto Company is sold out for immediate delivery, but with reckoning this a bull point it must not be overlooked that a good deal of copper is only held by speculators. Manufacturers are, however, fairly busy, and a survey of the whole position suggests the probability that we shall see a rising market for copper in the immediate future. The tone remains steady.

Tin has risen in sympathy with the advance in the price of the sister metal, the strength of copper having induced bear repurchases. There has been a certain amount of bear pressure for forward delivery, but spot tin has fallen away, owing to free offerings of metal, this, in its turn, causing a shrinkage in the backwardation for three months' delivery. The position is interesting. M[illegible] and Company's report points out that statistics at the end of the month are expected to show a substantial decrease, while the Straits show little inclination for business at the present range of prices. The market looks like going higher.

The market for lead also shows improvement, some good buying having been witnessed, with the result of temporarily clearing supplies. The latest tendency, however, is towards an easier market, the quotations being soft foreign £12 5s., and English £12 12s. 6d.

Spelter has had a sharp fluctuation. The price rose on good support from consumers, but the demand was freely met at the higher level, and finally prices reacted sharply.

The activity in other markets has been reflected on the iron exchanges, and a large speculative business has been transacted. Middlesbrough iron has been firm on good American advices, and quotations at the close were 48s. 8d. cash and 48s. 11d. one month. Large shipments of Cleveland iron to Scotland are to be noted.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

	£	s.	d.
Steel:			
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
,, ,, ,, Land	6	17	6
,, ,, ,, Ship Quality Plates	5	17	6
Siemens' Steel Bars, Boiler Quality	6	17	6
,, ,, ,, Ship	6	7	6
,, ,, Angles	5	7	6
Manufactured Iron:			
Bars—Dalzell	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

	£	s.	d.	
Steel Angles (Glasgow ♛ Steel)	5	7	6	per ton
Steel Ship Plates (Glasgow ♛ Steel)	5	17	6	,,
Steel Bars, Ship Quality (Glasgow ♛ Steel)	6	7	6	,,
Steel Bars, Boiler Quality (Glasgow ♛♛ Steel)	6	17	6	,,
Steel Land Boiler Plates (Glasgow ♛♛ Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow ♛♛ Steel)	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quotes:—

	£	s.	d.
Bars—[illegible]	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best [illegible]	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix			
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1.			No. 3.		
	£	s.	d.	£	s.	d.
Coltness, f.a.s. Glasgow	3	4	6	2	14	0
Gartsherrie ,,	2	19	0	2	14	0
Summerlee ,,	2	19	0	2	14	0
Carnbroe ,,	2	16	6	2	12	6
Langloan ,,	3	4	0	2	15	0
Calder ,,	2	19	0	—		
Clyde ,,	2	18	6	2	13	6
Glengarnock, f.o.b. Ardrossan	2	18	0	2	12	6
Eglinton ,, ,,	2	14	6	2	12	6
Dalmellington, ,, Ayr	2	14	6	2	12	6
Shotts ,, Leith	2	19	0	2	14	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works**:—

	£	s.	d.
W.W. ♛ Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby ♛	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. ♛ Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron.			Steel.		
		£	s	d.	£	s.	d.
♛	Bars	6	10	0	7	5	0
	Angles	7	0	0	7	5	0
(BNF)	Tees	7	10	0	7	15	0
♛	Hoops	7	0	0	7	10	0
W.I.W	Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in. per ton.		
Black Sheets:	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in. per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½% for cash monthly, 10th inst.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	15	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	11	7	6	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	15	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
,, ,, Best Best	9	5	0	,,
,, ,, Treble	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt and upwards. Extra 2½ per cent discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt.	d/d any Railway Station
4 cwt. lots and upwards 9/9 per cwt.	

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.	d/d any Railway Station.
4 cwt. lots 8/6 per cwt.	

Slit rods (iron) £7 10s per ton, at works for 2-ton lots

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb "BV"	0	12	4½
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	6
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	1½
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	6
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb "Allaway"	0	12	10½

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quote:

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

	£	s.	d.	
Steel:				
Blooms	at 3	12	0	per ton.
Billets	at 3	14	0	,,
Sheet Bars	at 3	16	0	,,
Finished Steel:				
Bars	at 5	0	0	per ton
Angles	at 5	1	0	,,
Tees	at 5	4	0	,,
Joists	at 4	10	0	,,
Fencing Standards	at 5	2	0	,,
Shoeing Bars	at 5	4	0	,,
Tyre Bars	at 5	4	0	,,
Half Round Bars	at 5	5	0	,,
Heavy Rails	at 4	15	0	,,
Light Rails	at 4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. ... Dis. 1¼% & 1%	130	10	0	to	131	0	0	per ton.
English Bars, f.o.b. ... Dis. 1¼% & 1%	131	10	0	to	132	0	0	,,
Straits G.M.B., cash Warehouse, Net	130	12	6	to	130	15	0	,,
Straits G.M.B., 3 months, Warehouse, Net	130	2	6	to	130	5	0	,,
Australian, Mt Bischoff, Warehouse, Net	131	0	0	to	131	5	0	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	68	6	3	to	68	7	6	per ton.
Standard G.M.B., 3 months, Warehouse, Net	68	12	6	to	68	13	9	,,
English, Tough, Cake & Ingot, Warehouses, Net	71	0	0	to	71	10	0	,,
English, Best Select, Warehouse Net	71	13	0	to	72	5	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½	80	0	0	to	80	10	0	,,
English Sheets for India, f.o.b., Dis. 2½	75	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	15	0	to	71	0	0	,,
Ore, ex ship	0	12	0	to	0	13	0	per unit
Regulus, Matte and Precipitate, ex. ship.	0	13	3	to	0	14	0	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½				0	0	6⅝	per lb.
Sheathing				0	0	6⅞	,,

SPELTER

	£	s.	d.		£	s.	d.	
Silesian outports, Net	24	0	0	to	24	5	0	per ton
Blende of 50% Net	6	10	0	to	7	0	0	,,
Calamine Net	6	10	0	to	7	0	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½	12	10	0	to	12	12	6	per ton.
Spanish, ex ship, Dis. 2½	12	5	0	to	12	10	0	,,
Lead Ore of 70% Net	6	4	6	to				,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus f.o.b. Dis. 2½	35	0	0	to	36	0	0	per ton.
Ore, 50% ex ship, Dis. 2½	8	10	0	to	9	10	0	,,
Crude ex ship, Dis. 2½	13	10	0	to	14	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	12	6	per flask
Italian	7	11	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.

	s.	d.
Main Coal	7	6
Best Hard Steam (hand picked, as used by the Railway Companies)	6	0
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:

	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

per ton at pit.

	s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

Steam.	s.	d.
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.

High Hazel.		
London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, ¾ to 2 in cube	5	6
Steam. Top Hard		
Best Hard	9	0
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb.
Picric, Crystals	0	0	11	,,
Tartaric ... at Manchester	0	0	10¾	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	9	10	0	per ton.
Grey ,,	11	10	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	24	0	0	per ton.
Sal-ammoniac, Lump, 1sts, $del^{d.}$ U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate ... f.o.b. Liverpool	13	5	0	,,
Arsenic: Best White Powdered ... net	12	5	0	,,
Bleaching Powder, 35% ... ,,	4	10	0	,,
Borax: British Refined Crystal ... ,,	12	0	0	,,
Coal Tar Products:				
Benzole, 50/90% ... ,,	0	0	6	per gal.
,, 90% ... ,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C. ... ,,	0	0	6	per lb.
,, ,, ,, 39/40° C. ... ,,	0	0	6¼	,,
,, ,, Liquid, 97/99% ... ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	9	,,
Creosote, ordinary good liquid ... ,,	0	0	1¼	,,
Naphtha, Crude, 20% at 120° C. ... ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8	,,
,, ,, 95% at 160° C. ,, ,,	0	0	9	,,
,, ,, 90% at 190° C. ,, ,,	0	0	10	,,
,, Rectified, flash point over 73° F. ... f.o.b. ,,	0	0	11	,,
,, Rectified, flash point over 100° F. ... f.o.b. ,,		1	0	,,
Naphthalene, all qualities.				
Pitch ... f.a.s. Manchester. ,,	1	11	6	per ton.
Copperas: Green, in bulk ... ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	19	0	,,
Cake ... ,,	1	2	6	,,
Copper: Sulphate	22	15	0	,,
Cyanides: 98% minimum ... f.o.b. net	0	0	8	per lb.
Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	24	5	0	,,
,, ,, Grey	21	15	0	,,
,, ,, Brown at Manchester	17	0	0	,,
Nitrate	24	0	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood): Miscible, 60 o.p.	0	2	10	per gal.
Solvent	0	2	7	,,
Potash: Bichromate ... delivered England	0	0	3	per lb.
Carbonate, 90/92% ... c.i.f. Hull	18	10	0	per ton.
Caustic, 75/80% ... ,, ,,	20	15	0	,,
Chlorate ... net	0	0	3$\frac{1}{16}$	per lb.
Montreal ... in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow ... net	0	0	5	per lb.

	£	s.	d.	
Soda: Ash, Caustic, 48 %, Ordinary .. net	5	5	0	per ton.
,, ,, ,, Refined ... ,,	6	5	0	,,
,, Carbonated, 48 % .... ,,	5	10	0	,,
,, ,, 58 % (Ammonia Alkali) ... .net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
Caustic, White, 77 % .... ,,	10	10	0	,,
,, ,, 70 % .... ,,	9	12	6	,,
,, ,, 60 % .... ,,	8	12	6	,,
,, Cream, 60 % .... ,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate .... c.i.f. Hull net	16	15	0	,,
Bicarbonate, in 1 cwt. kegs...........	6	15	0	,,
Bichromate... delivered England...	0	0	2¼	per lb.
Chlorate .... net	0	0	3$\frac{1}{16}$	per lb.
Nitrate...ex quay Liverpool, ... ,,	11	7	6	per ton.
Phosphate	9	5	0	,,
Prussiate ....net	0	0	3⅝	per lb.
Silicate, Solution, 140° Tw.	4	10	0	per ton.
Sulphate (Glauber Salts)...............	1	12	6	,,
,, (Saltcake, 95 %)...............	1	15	0	,,
Sulphur: Recovered	4	15	0	,,
Roll	6	15	0	,,
Flowers......................	7	10	0	,,
Zinc: Sulphate	6	15	0	,,

MINERALS.

	£	s.	d.	
Barytes: Lump Carbonate, 90/92%	3	10	0	per ton.
Sulphate, No. 1, White	2	15	0	,,
China Clay: of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore: Basis 50% c.i.f. British Ports	3	7	6	,,
Manganese: Lump c.i.f. Liverpool 10¼d.				per metallic unit.
Ochre: French JC .... f.o.b. Rouen, net	2	5	0	per ton.
,, JF	5	10	0	,,
Talc: (French Chalk).........c.i.f. Liverpool	3	10	0	,,

OILS, etc.

	£	s.	d.	
Aniline Oil .... net	0	0	1¾	per lb.
,, **Salt**......	0	0	4½	,,
Castor Oil: French, 1st pressure, f.o.b. Marseilles less 1½ %... ...	22	15	0	per ton.
English, 1st pressure, f.o.r. Hull, less 2½ %, ...	23	5	0	,,
Cocoa Nut Oil: Ceylon, ex store Manchester ...... net	29	10	0	,,
Cochin, ex store Manchester .. ... net	32	0	0	,,
Cotton Seed Oil: Refined at Hull, less 2½ %, naked	14	7	6	,,
Edible at Hull, less 2½ %, naked ...	14	17	6	,,
Glycerine: Crude, 80% .... net	31	0	0	,,
Linseed Oil: Raw at Hull, less 2½ %, naked	15	2	6	,,
Boiled at Hull less 2½ %, naked	16	2	6	,,
Starch: American Pearl at Manchester, net	8	15	0	,,
Dextrine.. .. ,, ,,	18	0	0	,,
Farina. .... ,, ,,	15	15	0	,,
Shellac: Standard TN orange spot		140/-		per cwt.
Turpentine: American... at Liverpool	38	0	0	per ton
Russian .. at Hull.. net	19	0	0	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine...............	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	0
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	3	10
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks....................	,,	0	0	9		0	0	11
Spruce Spars . .	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine .	per std.	22	10	0	to	32	10	0
2nd do. do. ...	,,	17	0	0		22	0	0
3rd do. do .	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	15	0		7	5	0
Lower Ports Spruce	,,	6	10	0		6	15	0
Spruce Boards................	,,	5	10	0		6	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	0	11		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak..............	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood ..	,,	0	1	0		0	1	3
Norway Mining Timber . ..	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak	,,	0	2	6		0	3	0
Norway Spars ..	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality . .	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality ..	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ..	,,	14	0	0		15	0	0
Gefle ..	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in italics.

20315a 04. S. H. Adams, Scotswood-on-Tyne. Feb. 15.—Improvements in penstocks and sluices. (Date applied for, Sept. 21st, 1904.)

28403a 04. E. Lines, London. Feb. 15th.—Improvements in and in manufactures for use and in connection with the treatment of sewerage and other liquids for the purification thereof.

2883. E. Parkes, Birmingham. Feb. 13th.—A composition for lining puddling and other furnaces in which pig or scrap iron is balled or melted, and for similar purposes.

2889. C. Dawe, Plymouth. Feb. 13th.—Improvements in oscillating steam and air engines.

2897. W. H. Luther, Glasgow. Feb. 13th.—Improvements in and relating to cranes and the like.

2903. A. E. Trevithick, London. Feb. 13th.—Steam superheater for locomotive boilers.

2922. C. A. Allison, London. Feb. 13th.—Improvements in triple valves for air-brake systems. (*A. B. Levy, U.S.A.*)

2923. C. A. Allison, London. Feb. 13th.—Improvements in valves for air-brake systems. (*A. B. Levy, U.S.A.*)

2924. L. Haneke, London. Feb. 13th.—Improvements in wrenches.

2933. P. G. Tismer, London. Feb. 13th.—Automatic [illegible] device and alarm for engines. (Date applied for, April 4th, 1904.)

2941. W. S. Morgan, Kingston-on-Thames. Feb. 13th.—An improved valve for automobiles. (Date applied for, Feb. 11th, 1904.)

2947. J. Badeker, London. Feb. 13th.—Improvements in metallic rod packings. (Date applied for, March [illegible], 1904.)

2951. R. Young and J. Yetton, London. Feb. 13th.—Improvements in or relating to internal combustion turbines.

2965. J. W. Wadkin and D. J. Jarvis, London. Feb. 13th.—Improvements relating to cutters for wood working and other machines.

2973. E. Richardson, London. Feb. 13th.—A new [illegible] regulating and release exhaust valve for steam and other motor engines.

2984. K. Gossweiler, London. Feb. 13th.—Improvements [illegible] to the manufacture of sheet metal vessels.

2997. J. T. and J. Taylor, Ltd., and W. G. Atkins, Batley. Feb. 13th.—An improved [illegible] for use in connection with [illegible].

3000. J. E. Lea, Glasgow. Feb. 14th.—Improvements in [illegible] and controlling the quantity of a stream of [illegible] through [illegible].

3006. E. Schofield, Brighouse. Feb. 14th.—An [illegible].

3011. J. McRae, London. Feb. 14th.—Improved device [illegible].

3015. T. Suzuki, London. Feb. 14th.—Improvements [illegible].

3028. C. Walton, and G. H. Rayner, Seascale. Feb. 14th.—Improvements in or relating to machinery for driving [illegible].

3031. P. A. W. Parkyn, and A. Allen, Manchester. Feb. 14th.—Improvements in superheaters for steam.

3039. E. Reynolds, London. Feb. 14th.—Improvements [illegible].

3048. C. B. Luckman, Birmingham. Feb. 14th.—Improved [illegible] water pipe [illegible].

3050. R. F. Black and The Wilkinson Sword Co., Ltd., London. Feb. 14th.—Improvements in [illegible] nuts.

3062. T. B. Pearson, London. Feb. 14th.—Adjustable expanding chain gear.

3064. A. Pomfret, London. Feb. 14th.—Improvements in or relating to apparatus for lubricating the cylinders and other parts of steam, gas, oil and petrol engines.

3096. J. E. Spagnoletti and A. Y. Hutchinson, London. Feb. 14th.—An improved engineer's tool for [illegible], gauging, levelling and other operations.

3097. P. M. Justice, London. Feb. 14th.—Improved means for locking nuts. (*The American Lock Nut Co., U.S.A.*)

3099. A. J. Howard, Leicester. Feb. 15th.—Improvements in feed water heating devices for steam boilers.

3175. A. M. Nicholas, London. Feb. 15th.—An improved rotary filtering apparatus for the separation of liquids or solutions from tailings, slimes, sewage, and the like.

3176. A. Aitchison and D. Upton, London. Feb. 15th.—Improvements in apparatus for moving articles in relation to the rolls of rolling mills.

3178. J. Hopkinson and Co., Ltd., and J. Hopkinson, London. Feb. 15th.—Improvements in valves and cocks.

3180. E. G. Harris, London. Feb. 15th.—Improvements in and relating to centrifugal pumps.

3187. C. Baxter and A. Eavold, London. Feb. 15th.—Improvements in or connected with starting and driving mechanism suitable for use with gas engines, electro-motors and other engines.

3199. A. C. Jackson, London. Feb. 15th.—New or improved nut lock.

3206. S. R. Stone, London. Feb. 15th.—An improved [illegible] hose cover (airtight).

3210. A. T. Cass, Keighley. Feb. 15th.—Improvements in [illegible] for the furnaces of steam generators and the like.

3215. J. L. Dunn and A. Dunn, Liverpool. Feb. 15th.—Improvements in or connected with furnaces more particularly applicable to steam generators.

3229. W. J. Crossley and A. V. Coster, Manchester. Feb. 15th.—Improvements in the method of cooling the pistons [illegible] of internal combustion engines.

3246. F. Windhausen, Junr., London. Feb. 15th.—Improvements in variable speed multiple stage turbines. (Date applied for, Feb. [illegible], 1904.)

3258. E. C. Harvey, London. Feb. 15th.—A new [illegible] machine for screwing up nuts on bolts [illegible] and performing like operations.

3268. J. N. Russell, London. Feb. 15th.—Improvements [illegible] heating [illegible].

3286. V. Schwaninger, London. Feb. 15th.—Improvements in means for operating valves or cocks by means of [illegible].

3288. The Warwick Machinery Co., Ltd., and F. Samuelson, London. Feb. 15th.—Improvements in or relating to throttle valves.

3302. N. L. Tullis, Glasgow. Feb. 15th.—Improvements in or connected with driving belts.

3309. J. Knowles, J. Rimmer and W. Liptrot, Manchester. Feb. 15th.—Improvements in metallic [illegible].

3319. J. A. Davenport, London. Feb. 15th.—A device [illegible] variable speed gear for driving [illegible].

3320. G. E. Charlesworth and W. Charlesworth, Sheffield. Feb. 15th.—Improved pedestal bearing for [illegible] wagons and the like.

3331. J. Stanton, Junr., Chorley. Feb. 15th.—Improvements in the construction [illegible] steam or vapour [illegible] generators, turbines, steam [illegible].

3357. C. A. Vandervell and W. Hodgson, London. Feb. 15th.—Improvements in and relative to [illegible] and the like.

3359. Fraser and Chalmers, Ltd., London. Feb. 17th. Improved means for securing parts to shafts such as tappets [illegible] stems of stamp mills. (*F. H. Mu[illegible] and H. McFarlane. [illegible]*)

3366. A. W. Herrick, London. Feb. 17th. Improvements [illegible] traction attachments for vehicles. (Date applied for [illegible])

3367. H. G. Nye, London. Feb. 17th.—Improvements [illegible] taps and dyes for cutting screw threads.

3368. Lobel (Louis) Wechselmann, Siegfried, Konigsberger and E. Freudenthal, London. Feb. 17th. Improvements in or relating to means for supporting miners' cages, [illegible] and other elevators.

RECENT SPECIFICATIONS.

GRAIN CONVEYERS.

Robert Boyd, Ltd., and T. Stevens, both of Bury St. Edmunds. April 20th, 1904. This invention relates to improvements in the arrangement and construction of machinery for conveying barley, malt or other grain or substances in maltings, warehouses and stores. The invention refers particularly to the construction known as band conveyers. In the upper part of the warehouse or store is constructed a frame which supports rollers placed at suitable distances apart upon which the carrying band

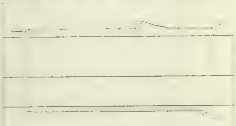


Fig. 1.

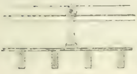


Fig. 2.

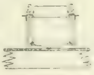


Fig. 3.

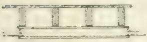


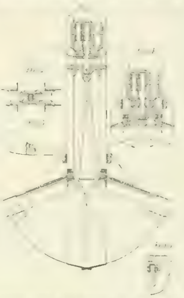
Fig. 4.

Fig. 5.

[illegible]. On each side of the band, rails of iron or wood are fixed [illegible] may be placed a [illegible] carriage fitted with rollers to deflect the carrying band, for the purpose of delivering the grain or other substance by the momentum [illegible] into suitably placed spouts [illegible]. The carriage can be fixed or clamped to the rails at the spot where the delivery of the grain or other substance is desired. [illegible] consists of an arrangement [illegible] rollers, [illegible] shaped box fixed [illegible] the [illegible], upon the bottom of which [illegible] carrying band [illegible] [illegible] the [illegible] [illegible] hinged [illegible] [illegible] arrangement of [illegible]. The trough or [illegible] [illegible] one side prevents the grain or other substance which [illegible] being spilt. The [illegible] may be fitted with a cover [illegible] if desired.

GRABS.

The Thames Ironworks Shipbuilding and Engineering Company, Ltd., and G. J. Hone, of Canning Town, E. Dec. [illegible] Relates to improvements [illegible] [illegible] No. [illegible] [illegible] improve the [illegible] [illegible]. The [illegible] invention [illegible] automatically at [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] provided [illegible] [illegible] [illegible] held [illegible] [illegible] [illegible] [illegible]. The [illegible] with coacting faces whereby the said pawls are prevented from falling into a position below the plane of the bottom of the balance weights, but are not [illegible] in their upward movement. The balance weights normally tend to hold the pawls in their uttermost



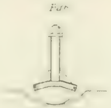


Fig. 6.

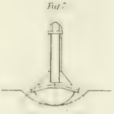


Fig. 7.

position, and fixed stops are provided on the frame of the grab to relieve the said pawls from the weights when the former are to engage with the notches in the posts. Another feature of the invention consists in attaching the buckets to the grab frame by means of external hinges. By this means not only is it possible to employ short hinge pins but the extent to which the grab can be opened is materially increased.

STEAM BOILERS.

E. S. Hindley, L. A. Hindley, H. D. Hindley and W. Stanford, all of Bourton, Dorset. March 15th, 1904.—The present invention has reference to [illegible] vertical type [illegible] those used for motor waggons and steam vehicles and [illegible]. According to this invention, [illegible] for maintaining the normal water level above the barrel portion of the boiler, thereby shortening the [illegible] the steam space and [illegible] thus enabling the engine to be used on steep inclines without causing any part of the internal [illegible] or tubes to be uncovered with water. This is effected by placing the barrel of the boiler as low down as possible and extending the external fire box [illegible]

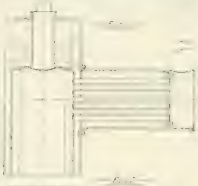


Fig. 1.

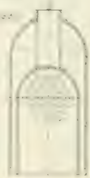


Fig. 2.

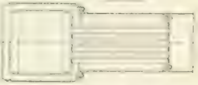


Fig. 3.

[illegible]

NEW PUBLICATIONS.

"THE MINING YEAR BOOK 1905."

With Directory of Directors, Secretaries, Mining Engineers and Metallurgists, and a Glossary of Mining Terms. Edited by A. N. Jackman, with an introduction by J. W. Broomhead. Published by "The Financial Times." 15s. net.

This is a work which should be in the possession of every investor, the information it contains is reliable, and the general arrangement to facilitate reference is all that can be desired. Mr. Broomhead is responsible for the very informing introduction, which in a concise manner, deals with the chief developments of the gold mining industry throughout the world. Our readers will be interested in the departure made this year in dealing with the output item. Since the war, most Transvaal companies have made their returns in fine gold, and this procedure was recently adopted by the majority of Westralian concerns. Under these circumstances the statistics hitherto given in this publication, have been replaced by a tabulated statement embracing the following comprehensive particulars covering recent years : tonnage of ore crushed, yield from mill, average ; total fine ounces ; working revenue, costs and profit—total under each heading, and amount per ton milled.

The entire work is arranged on the index plan ; mining, finance, exploration and allied companies are grouped in alphabetical order, and details concerning each company are placed under distinctive headings. The several valuable sketch maps of gold-producing countries have been brought up-to-date in matter of railway construction, etc., and the general utility of the glossary of mining terms has been greatly enhanced by the inclusion of French and German equivalents of the words defined.

"ENGINEER'S VALUING ASSISTANT."

Being a practical treatise on the valuation of collieries, and other mines, with rules, formulæ, and examples, also a set of valuation tables calculated on the principle of allowing interest to a purchaser of any annuity, benefit, or income, derived, or to be derived from mines or otherwise, at one rate of interest and redeeming the capital invested at another practical rate of interest, and table of value showing the discrepancies existing in the ordinary tables of present values and the errors created by them. By H. D. Hoskold, with an Introductory Note by the late Peter Gray, Second Edition. Longmans, Green and Co. 7s. 6d.

As pointed out in the introductory note, this work on the valuation of mineral property, contains matter of great interest for both the professional valuer and the actuary ; for the former in its ample discussion of the principles which should guide him in the discharge of his duties, and for the latter in its treatment of problems which arise in the practical application of those principles. The accuracy of the principles laid down by the author have been scientifically demonstrated by the late Mr. Peter Gray.

BOOKS RECEIVED.

A Pocket Book of Marine Engineering Rules and Tables for the Use of Marine Engineers, Naval Architects, Designers, Draughtsmen, Superintendents and all engaged in the design and construction of Marine Machinery, Naval and Mercantile. By A. E. Seaton and H. M. Rounthwaite. Charles Griffin and Co. Ltd.

The Journal of the Iron and Steel Institute. Vol. LXVI. Edited by Bennett H. Brough. E. and F. N. Spon.

Sell's Directory of Registered Telegraphic Addresses. Henry Sell. [illegible] and [illegible]

Practical Electric Light Fitting. A Treatise on the Wiring and Fitting Up of [illegible] Whittaker and Co. [illegible]

NEW CATALOGUES.

Messrs. D. Mitchell and Co. Ltd., of Keighley, forward a useful blotter with celluloid cover. This incidentally calls attention to the firm's radial drills, and shows an interesting selection of these machines.

"Reed Tools," the title of Catalogue F issued by the Fairbanks Company, 78—80, City Road, E.C., is rendered on the cover in vermilion lettering on a dark grey ground with block bordering and ornamentation and at once attracts the eye. This catalogue is devoted to stocks with solid dies, stocks with adjustable dies, pipe vises, combination vises, pipe cutters, pipe cutter wheels, pipe taps, pipe reamers, combination drill and tap, combination pliers, etc,, and shows decided originality. Its aim is to prove the truth of the claim put forward on the title-page in the words, "If you don't say 'Reed,' you don't get 'the best,'" a sentence which is repeated on almost every page throughout the catalogue.

In Bulletin No. 5 the Abner Doble Company, engineers, of San Francisco, illustrate and describe their tangential ellipsoidal water wheels. Bulletin No. 6 is a paper by H. C. Crowell, and G. C. D. Leoth, entitled "An Investigation of the Doble Needle Regulating Nozzle," printed by permission of the Civil Engineering Department of the Massachusetts Institute of Technology, and containing a number of interesting illustrations, diagrams, and tables.

Messrs. Joseph Robinson and Co., engineers and ironfounders, designers, and manufacturers of machinery for rubber and gutta-percha, and bleaching, dyeing, and finishing machinery, of Springfield Lane Iron Works, Salford, Manchester, forward leaflets giving lists of their manufactures.

Messrs. Graham, Morton and Co., Ltd., have issued an attractive little booklet with a red cover, upon the front of which are the words "Pocket this Nugget." and an embossed gold nugget. It illustrates, by means of some forty small blocks, the subject of handling and transporting materials.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, MAR. 3.—Royal Society, 9 p.m. Lecture, Mr. G. Marconi "Recent Advances in Wireless Telegraphy."—Liverpool Motor Show opens.—North East Coast Institution of Engineers, Newcastle.—Junior Institution of Engineers, Westminster Palace Hotel, 8 p.m. Paper, "Possible Improvements in Locomotive Practice," Mr. Walter Longland, M.I.Mech.E.—Geologists' Association. Paper, "The Diamond Mines of South Africa," Professor H. A. Miers, University College, Gower Street, 8 p.m.

SATURDAY, MAR. 4.—Glasgow Technical College Scientific Society, 7.30 p.m. Paper, "Steam Generators and their Furnaces," Mr. Geo. Ness, M.I.Mech.E.

MONDAY, MAR. 6.—Institute of Marine Engineers, Romford Road, Stratford, 8 p.m.: "Fuel Testing."—Society of Engineers, Royal United Service Institution, 8 p.m.—Society of Arts Cantor Lecture, 8 p.m., "Internal Combustion Engines," Mr. Dugald Clerk.

TUESDAY, MAR. 7.—Royal Institution, 5 p.m. Paper, "Some Recent Biometric Studies," Professor K. Pearson.—Zoological Society, 8 p.m.

WEDNESDAY, MAR. 8.—Automobile Club Annual Meeting.—Geological Society of London, 8 p.m.—Society of Arts Ordinary Meeting, 8 p.m.—Liverpool Engineering Society. Paper, "The Evolution of Harbour Engineering," Mr. A. F. Fowler, M.Inst.C.E.

THURSDAY, MAR. 9.—Royal Society, 4.30 p.m.—Royal Institution, 5 p.m. Paper, "Recent Astronomical Progress," Professor H. H. Turner.—Institution of Electrical Engineers, Great George Street, S.W., 8 p.m.—Dublin Electrical Engineers, Royal College of Science, Dublin, 8 p.m.

FRIDAY, MAR. 10.—Rugby Engineering Society, 8 p.m.: Paper, "The Minute Structure of Metals," Mr. J. T. Milton.—Physical Society.—Royal Society.—Royal Institution. Paper, "Structure of the Atom," Professor J. J. Thompson, F.R.S.

"IGRANIC"

(Patented)

MEANS

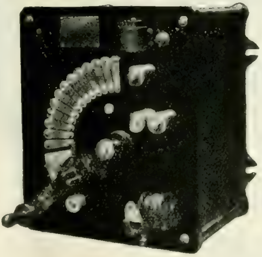
PROGRESS

IN

RHEOSTATS

STURTEVANT ENGINEERING CO., LTD.,

147, Queen Victoria Street, London, E.C.



Ice Making and Refrigerating Machinery.

CARBONIC
ANHYDRIDE (CO_2).

Ø Ø

AMMONIA
COMPRESSION
and
LOW PRESSURE
ETHER SYSTEMS.

Over 2,600 Machines
Built and Sold.

Ø Ø

Results Guaranteed.

Ø Ø

Prompt Deliveries.

Ø Ø

AWARDED SILVER
MEDAL, R.A. SHOW.
1904.

H. J. WEST & CO., Ltd.,

CABLES: "SAXOSUS."
TELEGRAMS: "COPPERWORM."
'PHONE: 879 HOP.

114 118, SOUTHWARK BRIDGE ROAD,
LONDON, S.E.

Contractors to H.M. Government, War Department, and India Office.

GAS ENGINES

to work with

Blast Furnace, Coke Oven, Producer, or Town's Gas, up to 3,000 B.H.P.

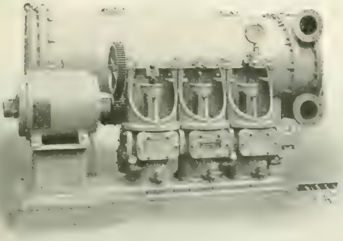
LOUIS SOEST & CO.,
LTD.,

**Engineers and
Ironfounders,**

114-116, VICTORIA STREET,
LONDON, S.W.

Sole Representative:—
PAUL J. MALLMANN.

Plans and Estimates
on application.

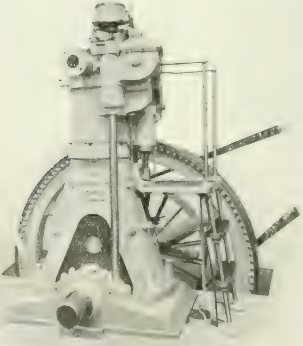


Condensing Plant . .

OF EVERY DESCRIPTION

Speciality :—

HIGH VACUUM.



THE

DIESEL OIL ENGINE

IS THE MOST
ECONOMICAL
ENGINE MADE,
AND IS
MORE RELIABLE
THAN ANY OTHER
OIL ENGINE.

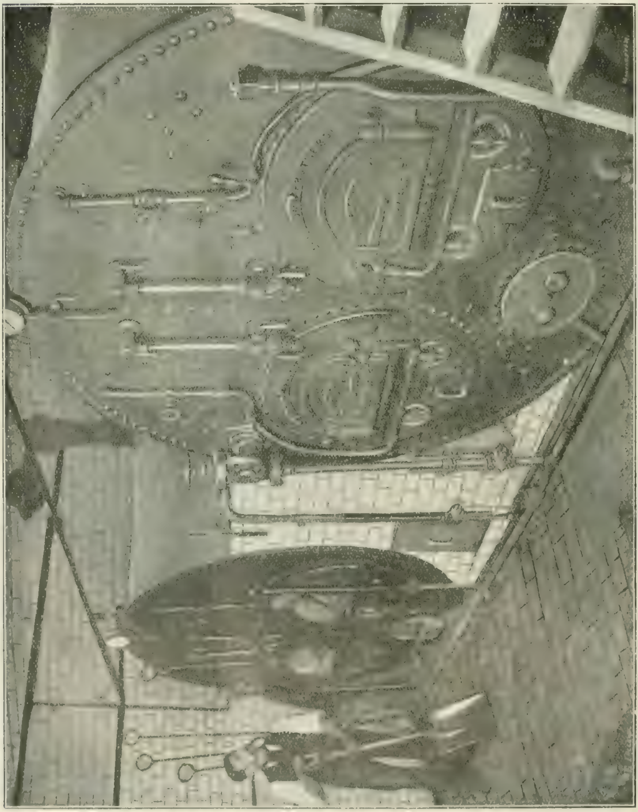
THE MIRRLEES WATSON Co., Ltd.,

GLASGOW.

PAGE'S WEEKLY Stokers

FURNACES.

13,000 WORKING.



MELDRUM BROS., Ltd., Timperley, MANCHESTER.

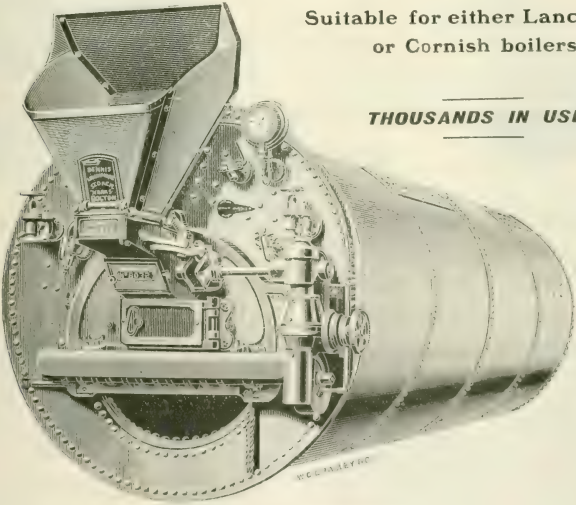
London Office: 66, VICTORIA STREET, WESTMINSTER, S.W.

BENNIS

STOKER & CAMEL FURNACES.

Suitable for either Lancashire
or Cornish boilers.

THOUSANDS IN USE.



Write for descriptive Booklet

ED. BENNIS & CO., LTD.,

Little Hulton Iron Works,

BOLTON.

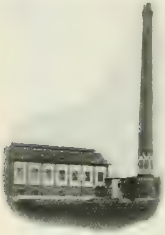
PAGE'S WEEKLY Destructors, &c.

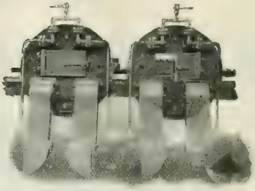
"Horsfall" Destructors.

LOW WORKING COSTS.

NO NUISANCE.

CHEAP STEAM.





Forced Draught.

For Boilers and Furnaces.

CLINKER CRUSHING & SCREENING MACHINERY.

MORTAR MILLS. CLINKER BRICK PLANTS.

Horsfall Destructor Co., Limited, Armley, LEEDS.

Telegrams: "Destructor, Leeds." *Codes:* Lieber's Standard and A.B.C. (5th Edition).

Boltons' Downtake Superheater WITH DOUBLE CIRCULATION.

IMPROVED BOX AND "FIELD" TUBES. (PATENTED.)

Simple and Reliable. Readily Applied. Inexpensive.

Saves 10 to 15 %.

Is made of Steel throughout.

A large number working in—
  Textile Mills,
  Paper Works,
  Collieries,
  Electricity Stations,
  Flour Mills, etc.

Suitable for any Working Pressure up to 200 lbs. per square inch.

Approved of by Leading Engineers and Insurance Co.'s.

REPEAT ORDERS BEING GIVEN.

PATENTEES AND SOLE MAKERS.—

A. BOLTON & CO.,

Engineers and Superheating Specialists,

49, Deansgate, MANCHESTER.

CLAYTON, SON & Co., LTD.

HUNSLET, LEEDS,

MAKERS OF THE

LARGEST STEEL TANK

AND THE

LARGEST GASHOLDER IN THE WORLD.

ROOFING,
CONSTRUCTIONAL
STEEL WORK,
PETROLEUM TANKS.

Wires. "Gas, Leeds."

London Office:— 60, Queen Victoria Street.

PAGE'S WEEKLY Locomotives, &c.

BALDWIN LOCOMOTIVE WORKS.

Established 1831. Annual Capacity 1,200 BROAD AND NARROW GAUGE

Single Expansion and Compound Locomotives.

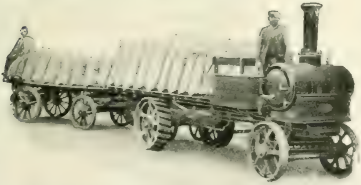
OPERATED BY STEAM OR COMPRESSED AIR.

Adapted [illegible]

Electric Locomotives and Electric Car Trucks with Westinghouse Motors.

Burnham, Williams & Co., Philadelphia, Pa., U.S.A.

Cable Addresses: "Baldwin, Philadelphia"; "Sanders, London." General Agents: SANDERS & CO., 110, Cannon St., London, E.C.



This illustration is of a Steam Wagon to carry 6 Tons and haul 4 Tons on a Trailer.

THE . .

Yorkshire Patent Steam Wagon Co.

(Branch of Deighton's Patent Flue and Tube Company, Ltd.),

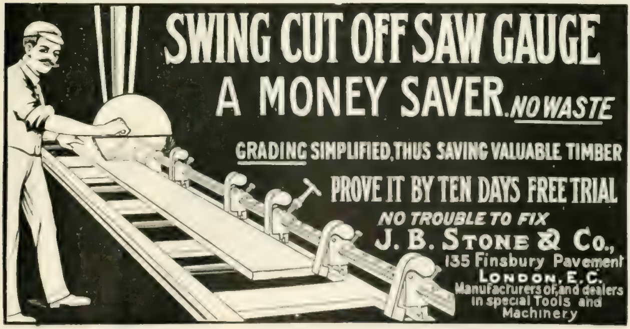
Pepper Road, Hunslet, Leeds.

MAKERS OF

STEAM MOTOR WAGONS

To suit any trade purpose, and to carry 3, 4, 5, and 6 tons.

Full particulars on application.



SWING CUT OFF SAW GAUGE
A MONEY SAVER. NO WASTE
GRADING SIMPLIFIED, THUS SAVING VALUABLE TIMBER
PROVE IT BY TEN DAYS FREE TRIAL
NO TROUBLE TO FIX
J. B. STONE & Co.,
135 Finsbury Pavement
LONDON, E.C.
Manufacturers of, and dealers in special Tools and Machinery

PAGE'S WEEKLY Iron and Steel

GILBERT THOMPSON & Co.,

IRON & STEEL WORK CONTRACTORS,
STRUCTURAL ENGINEERS, &c. . .

London Representative :
Paul J. Mallmann, M.A.,
Civil Engineer.

Telegrams : "MALLMANN, LONDON."
Telephone No. : 5338 WESTMINSTER.

LONDON OFFICE :
116, Victoria Street,
Westminster, S.W.

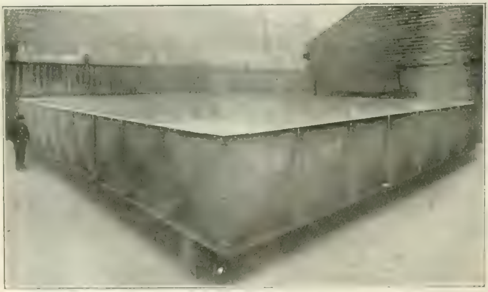
SPECIALITY : **POETTER'S GAS PRODUCING PLANT.**

IRON AND STEEL WORK OF ALL KINDS
. IN . .
GIRDERS, COLUMNS,
BRIDGES, ROOFS,
BUILDINGS, FENCING, &c., &c.

DESIGNS AND ESTIMATES
ON APPLICATION.

PROMPT DELIVERY AT
LOWEST PRICES.

F. A. KEEP, JUXON & Co.



RIVETTED WORK
OF EVERY DESCRIPTION

TANKS
FOR
ALL and EVERY
PURPOSE.

MISCELLANEOUS
IRON-PLATE and
CONSTRUCTIONAL
IRONWORK.

Forward Works.
BARN STREET,
BIRMINGHAM.

National Telephone 77
Telegrams Structures Birmingham

PAGE'S WEEKLY Iron and Steel

W. R. Renshaw & Co.,

Limited,

Manufacturers of . .

RAILWAY WAGONS,
WHEELS & AXLES,
AND IRONWORK,
ALL STEEL HIGH-CAPACITY WAGONS,

IRON & STEEL
STRUCTURAL WORK,
TANKS, ROOFS,
RIVETED GIRDERS AND PIPES.

London Office:
46, KING WILLIAM STREET, E.C.

Phœnix Works,
STOKE-ON-TRENT.

HERBERT W PERIAM L^TD.
FLOODGATE S^T WORKS
BIRMINGHAM.

TELEGRAPHIC ADDRESS
"FLOODGATE" BIRMINGHAM.

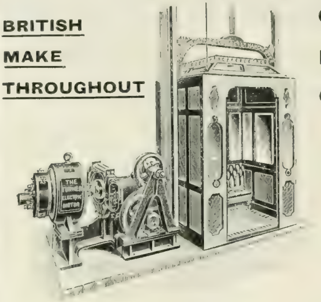
TELEPHONE Nº 373.

STOCK 250,000 GROSS

PAGE'S WEEKLY Electrical Apparatus, &c.

ELECTRIC LIFTS

BRITISH
MAKE
THROUGHOUT

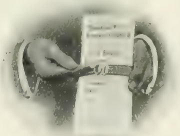


GOODS OR PASSENGER,
HAND-ROPE OR
CAGE-SWITCH CONTROL.

Reliable,
Durable,
and of Simple
Mechanical
Construction.

TURNER, ATHERTON & Co., Ltd.,
Head Office and Works, DENTON, MANCHESTER.

TITAN DOCUMENT BINDER.
Indispensable to
Engineers, Shipbuilders, Electric Lighting Stations, Collieries, Iron and Steel Works, &c.



Thousands of firms supplied, some of whom are Sir W. G. Armstrong, Whitworth & Co. Ltd., Babcock & Wilcox Co. Ltd., Leeds Forge Company, Ltd., Manchester Ship Canal, John I. Thornycroft & Co. Ltd., Denney & Co., Dumbarton, etc., etc.

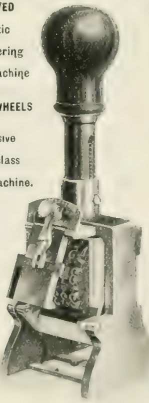
A SAMPLE SENT FREE ON REQUEST.

THE TITAN BINDER COMPANY,
31, Queen Victoria Street, LONDON, E.C.

IMPROVED
Automatic
Numbering
Machine

STEEL WHEELS

Inexpensive
First-class
Machine.



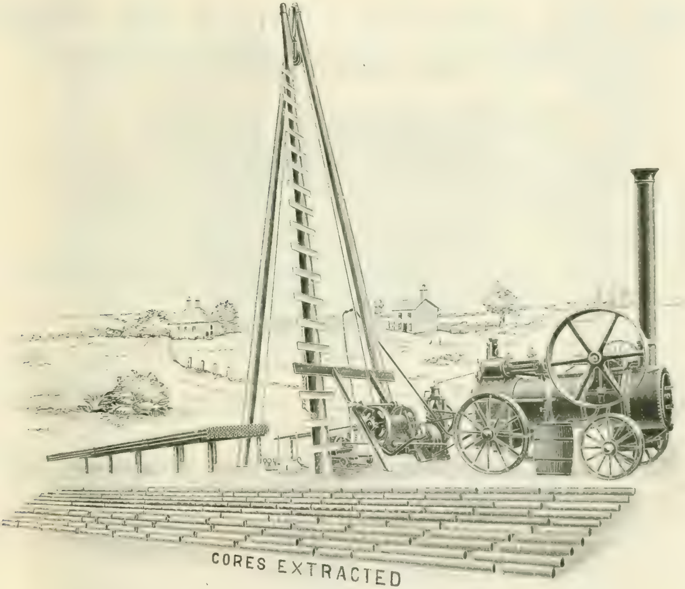
OUR SPECIALITIES:—

Perforating Presses
Embossing ,,
Company Seals
Steel Dies & Punches
Wrot-iron Brands
Patent Stencil Drums & Stencil Plates
ENGINEERS' INSTRUCTION and NAME PLATES.

RUBBER STAMPS SPECIALLY MOUNTED With Sponge Rubber Seating.

THE RUBBER STAMP COMPANY,
4, Broad St. Corner, BIRMINGHAM.

PAGE'S WEEKLY Artesian Bore Wells



Mineral and Artesian Well Boring Machinery

supplied, and Borings contracted for, by . .

JOHN Z. THOM,

PATRICROFT.

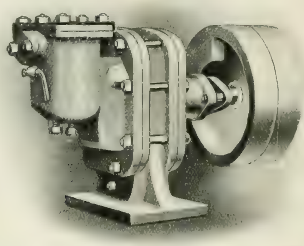
Telephone: 69 ECCLES.
Telegrams: "THOM, PATRICROFT."

PAGE'S WEEKLY Pumps, Condensers, &c.

The Best Industrial Pump in the World

FOR ANY DRIVE.

FOR
ANY
LIFT.



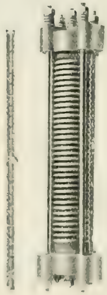
FOR
ANY
MATERIAL.

POSITIVE ROTARY PUMPS, LTD.,

23, NORTHUMBERLAND AVENUE, LONDON, W.C.

A PERFECT INSTRUMENT.

THE
SIMPLEST
CONDENSER



IN
THE
WORLD.

CONCENTRIC CONDENSER, LTD.,

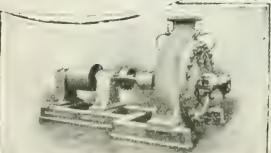
23, Northumberland Avenue, LONDON, W.C.

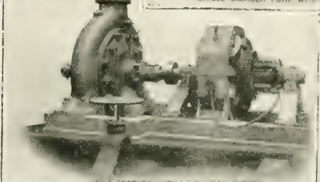
HIGH-LIFT TURBINE PUMPS

INTEGRITY AND INDUSTRY

4 CHAMBER PUMP & A C ELECTRIC MOTOR

PUMPS
ALREADY
SUPPLIED FOR
$3\frac{3}{4}$ MILLION
GALLONS
PER HOUR.


SINGLE CHAMBER PUMP WITH PULLEY


[illegible] CHAMBER PUMP & ELECTRIC MOTOR

TELEGRAMS
MATHER
MANCHESTER

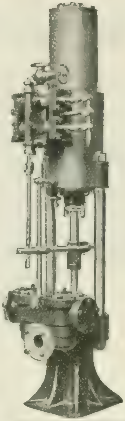
TELEPHONE
Nos. 5781, 5782
5783

MATHER & PLATT LTD.
SALFORD IRONWORKS
MANCHESTER.

PAGE'S WEEKLY Pumps, Turbines, &c.

THE BRUUN-LOWENER
WATER-SOFTENER
PROTECTED BY LETTERS PATENT
SIMPLE SIMPLE
AUTOMATIC AUTOMATIC
RELIABLE RELIABLE
OVER 1000 PLANTS IN OPERATION
TREATING MILLIONS OF GALLONS OF WATER
SOLE MANUFACTURERS
LASSEN & HJORT,
ENGINEERS
52, QUEEN VICTORIA ST., LONDON, E.C.

J. P. HALL & SONS, Ltd.,
ENGINEERS,
PETERBOROUGH.



We make a SPECIAL Compound Direct Acting Slow Running

Boiler Feed Pump

ECONOMICAL AND EFFICIENT.

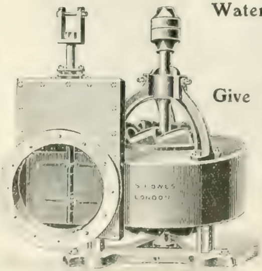
We deliver 100 lbs. of Water for the expenditure of 1 lb. of Steam. This with our 2,000 gallon Pump, and a much higher efficiency as the size of the Pump increases.

AN IDEAL PUMP FOR GENERAL BOILER FEEDING PURPOSES.

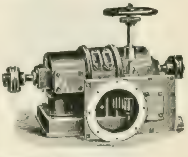
Apply for Particulars.

"Little Giant" Turbines.

Water Wheels, Water Motors, and Pelton Wheels.
Simplest to Operate.
Cheapest to Erect and Maintain.
Give Greatest Efficiency. Cheapest to Buy.
Require Smallest Amount of Water.



Over . .
10,000
"Little Giant"
Turbines
made and in use.



OUR LATEST TREATISE ON WATER DEVELOPMENT FREE ON APPLICATION.

S. Howes Co. Sole Manufacturers of "Little Giant" Turbines, Turbine Governors, &c. Government Contractors. (Established 1856.)

Head Office — 64, MARK LANE, LONDON, ENGLAND.

PAGE'S WEEKLY Systems for Engineers

SHANNON SYSTEMS

The Shannon Letter Copier.

Dealing with Correspondence.

FIRST: Copy your letters, agreements, and other outgoing correspondence on the **Shannon Letter Copier**, which copies ten times as quickly as an ordinary screw press.

SECOND: File the copies of answers with the original letters received in a **Shannon Letter Filing Cabinet**, in alphabetical and chronological order.

THE RESULT:

Perfect Copies. Instant reference to outgoing and incoming correspondence. Great saving of time, worry, and hard cash.

Shannon Letter Filing Cabinet.

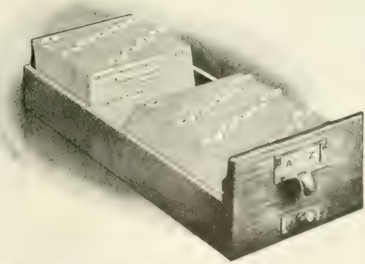
Write for our Booklet No. 20, which deals exhaustively with this modern system.

The Shannon Ltd.,

Head Offices and Showrooms:
Ropemaker St., LONDON, E.C.
F. W. SCHAFER, Managing Director.

A Single Idea with Vast Possibilities

Have you seen what a Card Index can do?



If you have not, we will be glad to show you.

THE LYLE COMPANY, LIMITED,
HARRISON STREET, GRAY'S INN ROAD,
LONDON, W.C.

PAGE'S WEEKLY Time Recorders

EMPLOYERS OF LABOUR

Can save at least 5% ON THEIR WAGES BILL, and thousands of employers do so by the use of the

"Dey" Time Registers

which are automatic machines for registering the hour and minute at which Employees start and finish work,

and, with the New Attachment provides, in addition to the weekly time and wages sheets, the CARD SYSTEM for COST KEEPING.

The "DEY" combines on **THE ONE MACHINE** the good points of all other Automatic Time Recorders on the market.

They are of British Manufacture Throughout.

They are absolutely the best Time Recorders in the World.

They are the cheapest up-to-date machine on the market.

They are guaranteed perfect in every detail.

THEY COMPEL PUNCTUALITY.

The "Dey" time and wages sheets combined do away with time books, wages books, and save 90% of clerical work. They are adaptable to every requirement, no matter how complicated.

A firm using 15 machines writes: "We shall be sorry when we change the boiler-shop machine, as it was one of the earliest, and has had the roughest of usage together with the maximum of vibration, and rudest of shocks; but it has gone on working the whole time (nearly six years) night and day, and when it goes to you for repairs, it will be the first time it has been in the infirmary."

Full particulars from the Patentees and Manufacturers:—

HOWARD BROS.,
10, St. George's Crescent, LIVERPOOL.
TELEGRAPHIC ADDRESS: "SONNEZ, LIVERPOOL." TELEPHONE 716 LIVERPOOL.

London Offices: 100c, Queen Victoria Street, E.C.
TELEGRAPHIC ADDRESS: "COUNTABLE, LONDON." TELEPHONE: 509 BANK

PAGE'S WEEKLY Printing

REMINDER

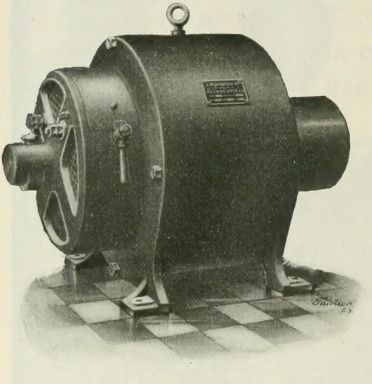
Catalogue and Circular Specialists.

THE
ATLANTIC PRESS Ltd.
Weymouth Street,
Manchester, S.E.

Are you on our mailing list?
If not drop a P. C.

PAGE'S WEEKLY Miscellaneous

T. W. BROADBENT,



STANDARD MOTOR—Open, Protected, or Enclosed.

Victoria . . .
Electrical Works,

Huddersfield.

Specialities:

DYNAMOS,
MOTORS,
SWITCHBOARDS.

MORETON'S E.G. PAINT.

(ELECTRO GALVANISING.)

Unequalled for . .

Coating all kinds of Machinery.

Ask for, and see you get the only genuine. Guaranteed heat up to 400 degrees Fahr., and is not affected by climatic conditions. to withstand

Trade Mark. H. Moreton

THE PAINT THAT WON'T COME OFF.

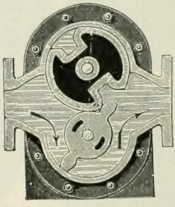
Send for Sample of the Sole Manufacturers—

The Metallic Paint Co., Ltd., Cardiff.

THE . . .

"DRUM" PUMP.

JOHNSON'S PATENTS.



SECTION OF "DRUM" PUMP.

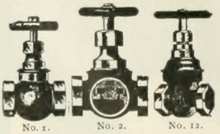
Write for Catalogue 63.

POSITIVE ACTION.
NO VALVES.
HIGH EFFICIENCY.

DRUM
ENGINEERING CO.,
27, Charles St.,
BRADFORD.

BRITISH STEAM SPECIALTIES, LTD.,

LEICESTER, & 80, TURNMILL ST., LONDON, E.C.


No. 1.
No. 2.
No. 12.

No. 1. Standard Globe Valve.

¾in.	1in.	1¼in.	1½in.	2in.
4/-	5/6	9/-	11/6	16/-

No. 2. Renewable Disc Globe Valve.

¾in.	1in.	1¼in.	1½in.	2in.
5/6	7/-	10/-	13/-	20/-

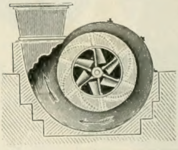
No. 12. Standard Fullway Gate Valve.

¾in.	1in.	1¼in.	1½in.	2in.
4/-	6/-	8/-	11/-	16/-

VALVES ALL TYPES. LIBERAL DISCOUNT

The CAPELL Patent Mine Fan

IN USE ON MINES ALL OVER THE WORLD.



Furnace Gas Cleaning Fans
(In large use).

Induced & Forced Draught Fans.

Fans for Ventilation of Buildings.

ADVANTAGES :—
Highest Economy in Power.
Small Size of Fans.

CAPELL FAN CO., 13, Moseley St., NEWCASTLE-ON-TYNE.

GREEN'S ECONOMISER

Saves 15 to 25 per cent. in Coal.

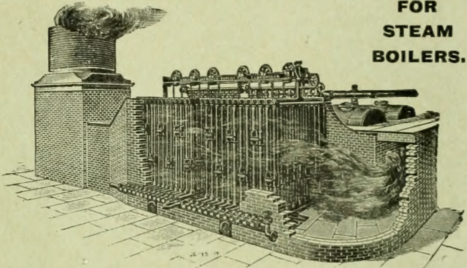
MAKES
EASY
WORKING
IN THE BOILER HOUSE.

FOR
STEAM
BOILERS.

More Steam and higher efficiency at less cost. Large reserve of feed water at evaporative point always ready on sudden demand for extra power.

Catalogue gives details.

E. GREEN & SON, Ltd., WAKEFIELD, MANCHESTER, LONDON, AND GLASGOW.

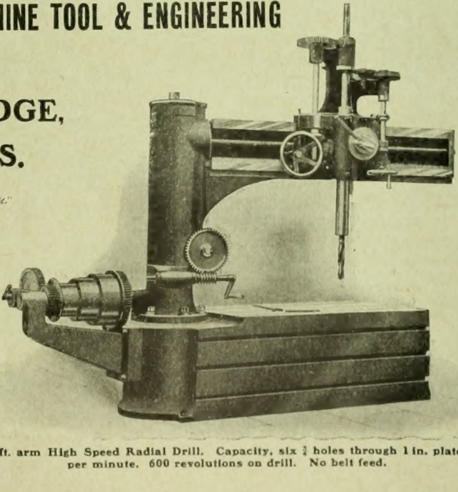


YORKSHIRE MACHINE TOOL & ENGINEERING WORKS,

LIVERSEDGE,
Nr. LEEDS.

Telegraphic Address: "Alma, Liversedge."
Nat. Tel.: 38 Heckmondwike.

Designers and Builders of High-Class Machine Tools.



6 ft. arm High Speed Radial Drill. Capacity, six ¾ holes through 1 in. plates per minute. 600 revolutions on drill. No belt feed.

The POWER-GAS CORPORATION LTD.,

39, VICTORIA STREET, LONDON, S.W., and STOCKTON-ON-TEES.

PRODUCER=GAS SPECIALISTS,

And MANUFACTURERS of

PRODUCER-GAS PLANT for POWER & HEATING

WITH OR WITHOUT AMMONIA RECOVERY,

UNDER **MOND, DUFF** AND **TALBOT** PATENTS.

CONTRACTORS TO HIS MAJESTY'S AND OTHER GOVERNMENTS.

JAMES FAIRLEY & SONS,

General Steel Manufacturers, and SPECIALISTS in . . **TOOL STEELS**

Invite attention to their Unrivalled Self-hardening Steel.

FAIRLEY'S **SELF-HARDENING** TOOL STEEL

FOR HEAVY CUTS AT HIGH SPEEDS.

Is considered to be the HARDEST and TOUGHEST Steel yet made (although the cheapest in the Market). Small samples free to approved buyers.

NOTE.—JAMES FAIRLEY & SONS' WORKS (Bramall Lane, Sheffield, and Mill Street Forge and Rolling Mills, Birmingham) are merely Branch Departments, and

All Communications should be addressed to the Head Offices :—

OLD MINT, SHADWELL STREET, BIRMINGHAM.

DELTA METAL

Bars of any Section in Brass, Bronze, or Delta Alloys, Forgings, Castings, Stampings, Sheets, Wire, Tubes.

DICK'S PATENT EXTRUDED METALS.

THE DELTA METAL CO., LTD. *110, Cannon St., LONDON, E.C.*

WORKS :— LONDON AND BIRMINGHAM

Printed for the Proprietors by SOUTHWOOD, SMITH & CO., LIMITED, 6, 7, 8, 9, Plough Court, Fetter Lane, London, E.C., and Published at Clun House, Surrey Street, Strand, London, W.C.